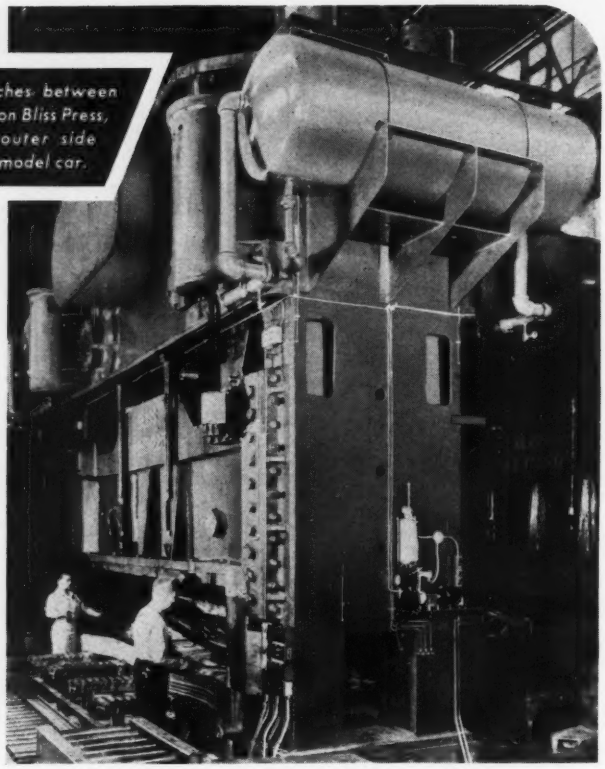
Lubrication ENGINEERING

JOURNAL OF THE AMERICAN SOCIETY OF LUBRICATION ENGINEERS



Measuring 220 inches between uprights, this 2,000-ton Bliss Press, one of two, forms outer side rails of a popular 1949 model car.

2,000-TON BLISS RAIL PRESSES PROTECTED BY TRABON SYSTEMS

• It is significant that one of the nation's largest automobile manufacturers has specified Trabon Centralized Lubricating Systems for automatic grease lubrication of its two new 2000-ton Rail Presses.

This same manufacturer has also specified Trabon Automatic Oil and Grease Lubrication for upsetter and forging press lubrication at its two new forge plants in Michigan and Ohio.

Add to this evidence the fact that one of the country's largest body manufacturers has specified Trabon Systems for its presses at its huge new midwestern plant, and you begin to realize the importance of Trabon's Positive Feed Principle of Feeder Operation to executives and plant maintenance men who are faced with large scale lubricating problems.

The fact that these operating and maintenance men, who have had experience with almost every type of manual, semi-automatic and automatic method of lubrication have selected Trabon is highly significant. Call or write Trabon today for experienced help in solving your lubricating problems.

CHECK THESE FEATURES

- ✓ **Trabon Is Positive** — Every Bearing Gets a Full Measured Amount.
- ✓ **Trabon Is Hydraulic** — Handles Oil or Grease.
- ✓ **Trabon Has A Single Indicator** — Progressive Feeder Action Permits Completely Sealed System with Single Indicating Point at Pump.
- ✓ **Trabon Systems Are Versatile** — For Large and Small Machines, with Manual or Automatic Pumps.

Trabon ENGINEERING CORPORATION

1814 EAST 40TH STREET • CLEVELAND 3, OHIO

Centralized Oil and Grease Systems

Where
CUTTING FLUID
THEORY & PRACTICE Meet

SELDOM does the most carefully developed scientific theory provide the final answer in the shop; neither is practical experience entirely dependable. It usually takes a combination of both in order to select and apply the cutting fluid that will give the best results on a given machining job.

D. A. Stuart Oil Company offers you a combination of theory and practical experience that pays dividends in better machining and fewer production headaches. The *theory* emanates from research in the modern D. A. Stuart laboratories; *practical* approach comes from men who have years of experience in shop problems and techniques. That is why Stuart products so often smooth out jobs on which other cutting fluids fail. Ask your D. A. Stuart Oil Co. representative to tackle your tough jobs.

ON-THE-JOB REPORTS PROVE RESULTS

". . . D. A. Stuart's SOLVOL Water Mixed Cutting Compound was put in on a trial basis for milling high carbon alloy steel. High speed alloy cutters were used and it was found that SOLVOL increased the cutter life 3 to 4 times over what they had been getting. . . ." Write, if you would like to have a booklet on SOLVOL.

STUART *oil engineering goes with every barrel*

D.A. Stuart Oil Co.

2729-51 S. TROY ST. • CHICAGO 23, ILLINOIS

Lubrication ENGINEERING

VOL. 4 DECEMBER, 1948 NO. 6

In This Issue

The Editor's Page 251
Antifriction Bearing Developments—A. Stewart Murray 252
The Significance of Chemical Tests to Consumers of Lubricants—William Eismann, Jr. 257
Effects of Cutting Fluids and Power Requirements in Metal Cutting Operations—A. O. Schmidt and G. V. B. Sirotkin 261
Current Literature 266
New Products and Equipment 267
News of the Sections 270
Section Officers and Committees 271
Patent Abstracts, Oils and Lubricants 273
Convention Announcement 280
Annual Index, Vol. IV 282
A.S.L.E. Membership Roster 284
Advertisers' Index 296

LUBRICATION ENGINEERING
Official Publication of the American Society of Lubrication Engineers
343 SOUTH DEARBORN ST., CHICAGO 4, ILL.

BURGESS H. JENNINGS, *Editor*
Northwestern Technological Institute, Evanston, Ill.

OFFICERS OF THE AMERICAN SOCIETY OF LUBRICATION ENGINEERS

	Regional Vice Presidents	Directors	Directors
G. L. SUMNER East Pittsburgh, Pa. President	C. M. LARSON Eastern New York 20, N. Y.	L. A. DANSE Detroit 2, Michigan	HENRY E. MAHNCKE East Pittsburgh, Pa.
W. F. LEONARD Chicago, Ill. Secy. and Treas.	N. C. PENFOLD Mid-Western Chicago 16, Illinois	W. T. EVERITT Rochester, New York	M. E. MERCHANT Cincinnati 9, Ohio
B. H. JENNINGS Evanston, Illinois Vice Pres. at Large	L. W. McLENNAN, Western Oleum, California	E. M. KIPP New Kensington, Pa. R. P. McKIBBEN Dayton 9, Ohio	B. G. SYMON New York 20, New York

Subscription price, $4.00 per year. Single copies, 75c each, postpaid. Published bi-monthly.

Copyright: Copyright 1948 by the American Society of Lubrication Engineers.

The A.S.L.E. will not be responsible for statements or opinions advanced in its meetings or printed in its publications.

Address correspondence regarding contents, manuscripts, etc., to the editor at Northwestern Technological Institute, Evanston, Ill.

Inquiries regarding advertising space and rates should be addressed to W. F. Leonard, Lubrication Engineering, 343 S. Dearborn St., Chicago 4, Ill.

MACHINES OF GREAT PERFORMANCE USE THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED

Illustrated is Madison-Kipp Lubricator Model FD installed as original equipment on a 3/8" by 20' Cincinnati Press Brake, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio.

MADISON-KIPP

Fresh Oil . . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

MADISON-KIPP CORPORATION

223 Waubesa Street, Madison 10, Wis., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

High Temperature Lubrication...400°F. and up!

Lubrication of kiln-car wheels proved a headache to a large manufacturer of ceramic bodies for spark plugs. Heavy oil carbonized, freezing the wheels; powdered graphite was unsuccessful, too. The cure was **"dag"** colloidal graphite dispersed in kerosene.

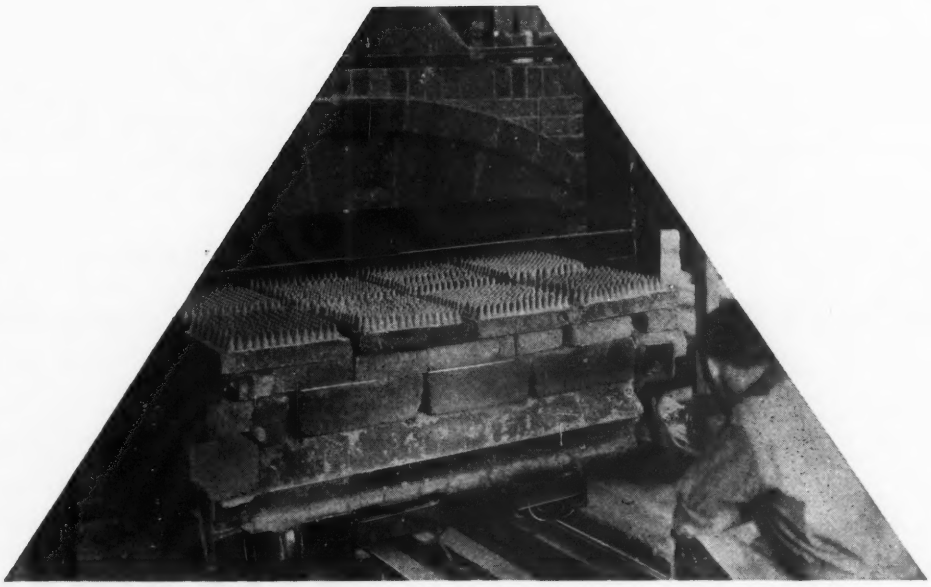
Wherever lubrication at high temperatures is a problem, one of the **"dag"** colloidal graphite dispersions is a possible solution. Let Acheson Colloids engineers help you...all you have to do is ask.

"dag" colloidal graphite dispersions are also successfully used for opaquing, parting, impregnating, general lubrication and electronics work.

Clip and mail the coupon **NOW** for more information.

Acheson Colloids Corporation, Port Huron, Michigan; Boston; New York; Philadelphia; Pittsburgh; Cleveland; Detroit; Chicago; St. Louis; Los Angeles; San Francisco; Toronto.

dag
REG. U.S. PAT. OFF.
COLLOIDS



Send us information on "dag" colloidal graphite dispersions for:

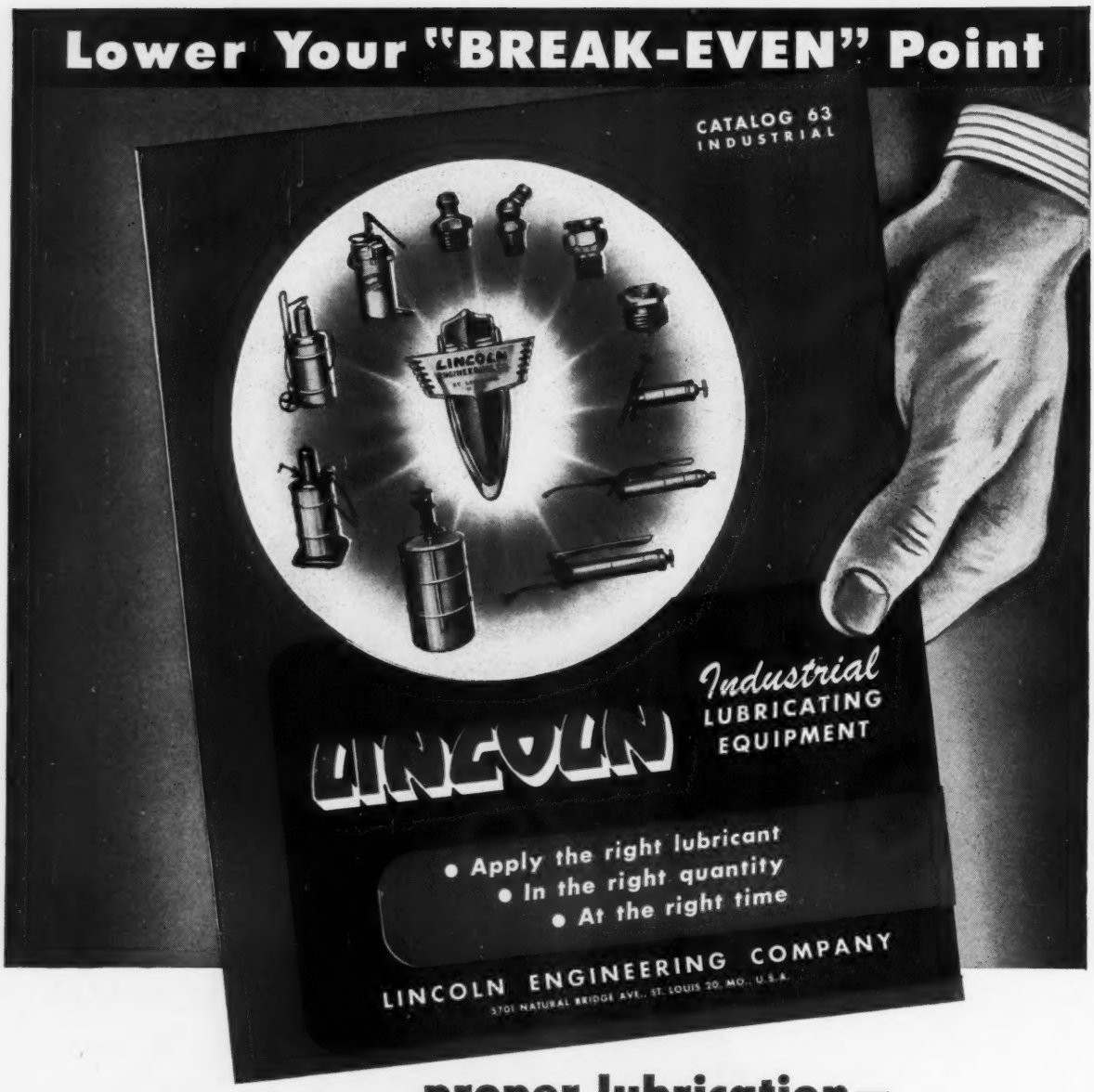
Extreme (high or low) temperature lubrication ☐
General lubrication ☐ Impregnating ☐
Parting ☐ Opaquing ☐ Electronic applications ☐

KK12

40th ANNIVERSARY YEAR

Acheson Colloids Corporation Port Huron, Michigan

Lower Your "BREAK-EVEN" Point



proper lubrication—
the LINCOLN way—cuts costly "down-time"

Steadily rising operating overhead can be curtailed by proper methods of lubrication. Costly "down-time" to repair damaged bearings — slowed production — excessive maintenance costs — heavy power consumption caused by faulty lubrication — can all be reduced to a minimum by lubricating the Lincoln way! Lincoln's new Industrial Lubricating Equipment Catalog No. 63 and Centro-Matic Bulletin No. 801 show you how...get your copies today!

Ask your Wholesale Distributor, or write to any of the Lincoln offices listed below.

SALES AND SERVICE OFFICES

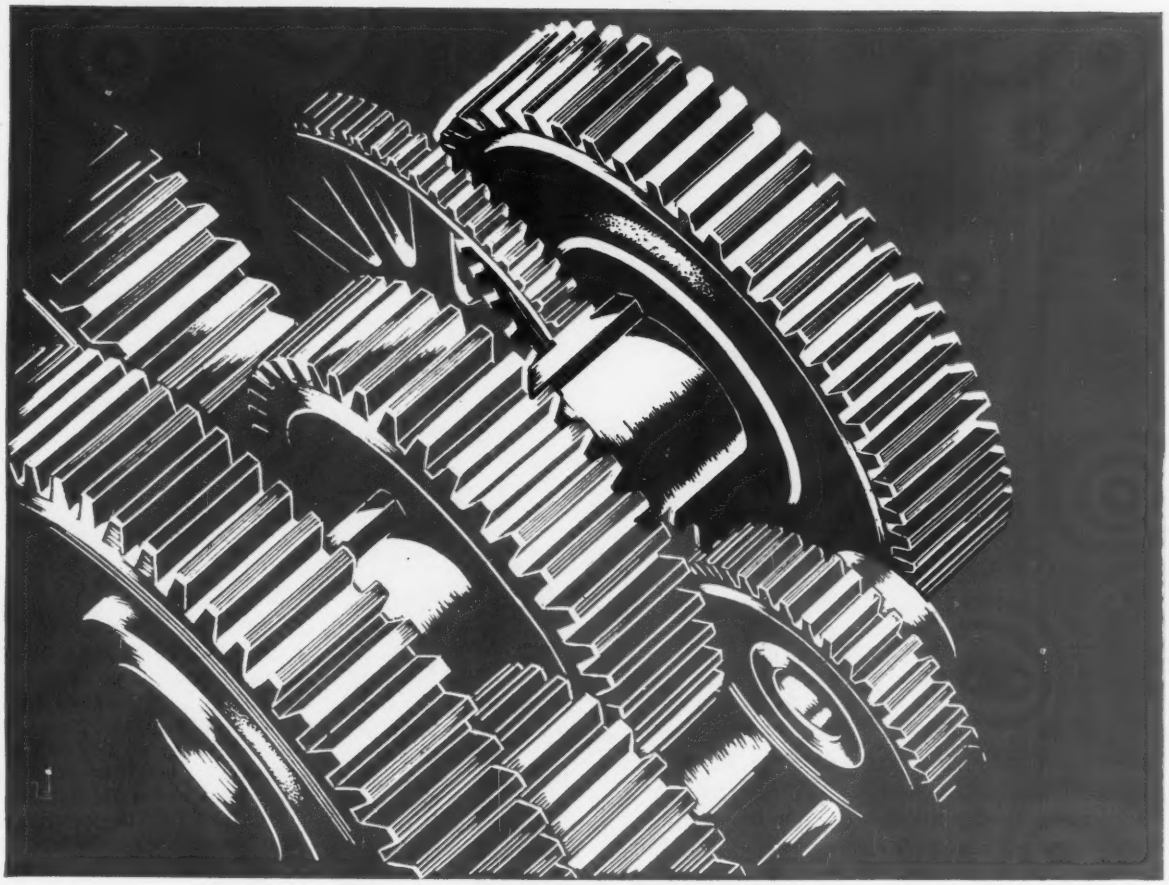
BOSTON—H. G. Davis, Inc.—Kenmore 5176
BRIDGEPORT—H. G. Davis, Inc.—Bridgeport 5-8160
CHICAGO—Lincoln Engineering Co. of Ill.—Calumet 6022
CLEVELAND—Lincoln Lubricating Systems, Inc.—Express 4334
DETROIT—Lincoln Engineering Co.—Madison 3484
EAST ORANGE—Lincoln Lubricating Systems, Inc.—Orange 3-3188
FORT WORTH—Fritz Keller—2-1345
LOS ANGELES—Lincoln Engineering Co. of Calif.—Richmond 0151
MILWAUKEE—Lincoln Equipment Service—Division 1191
NEW YORK—Lincoln Lubricating Systems, Inc.—Trafalgar 7-7900
OAKLAND—Lincoln Engineering Co. of Calif.—Higate 6130
PHILADELPHIA—Lincoln Engineering Co.—Locust 4-3877
PITTSBURGH—Lincoln Engineering Co.—Montrose 1444
PORTLAND—Pioneer Equipment Company—Lancaster 0488

Lincoln is the originator of the Kleenseal Surface Check Grease Fitting—the new, modern fitting with the ball in the top.

LINCOLN

LINCOLN ENGINEERING COMPANY
Leaders in Lubricating Equipment for a Quarter Century
5701 NATURAL BRIDGE AVE., ST. LOUIS 20, MO.

YES! Tycol "Engineered Lubrication" performs better . . . BETTER . . . BETTER



Tycol Engineered Lubrication performs better because:

. . . *Tycol Engineered Lubrication* supplies the scientific answer to every lubricating need in industry—from spindle oils for textile plants to roll neck greases for steel mills.

. . . *Tycol Engineered Lubrication* boosts production by promoting efficient, smoother-running machine operation . . . there's a Tycol oil or grease "engineered" for your specific job.

. . . *Tycol Engineered Lubrication* slashes costs by prolonging equipment life, protecting it against wear and tear . . . repair bills and "down time" are invariably reduced.

Let Tide Water Associated help you select the best lubricant for your particular need. Write, wire or phone today to your nearest Tide Water Associated Office for full details.

TYCOL
INDUSTRIAL LUBRICANTS

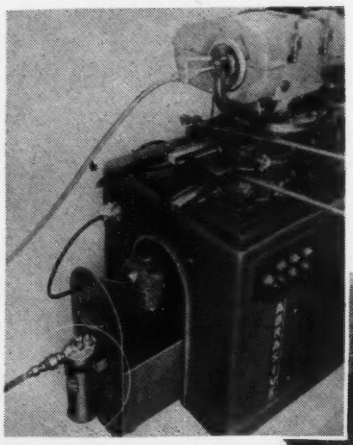
Boston • Charlotte, N. C.
Pittsburgh • Philadelphia
Chicago • Detroit • Tulsa
Cleveland • San Francisco

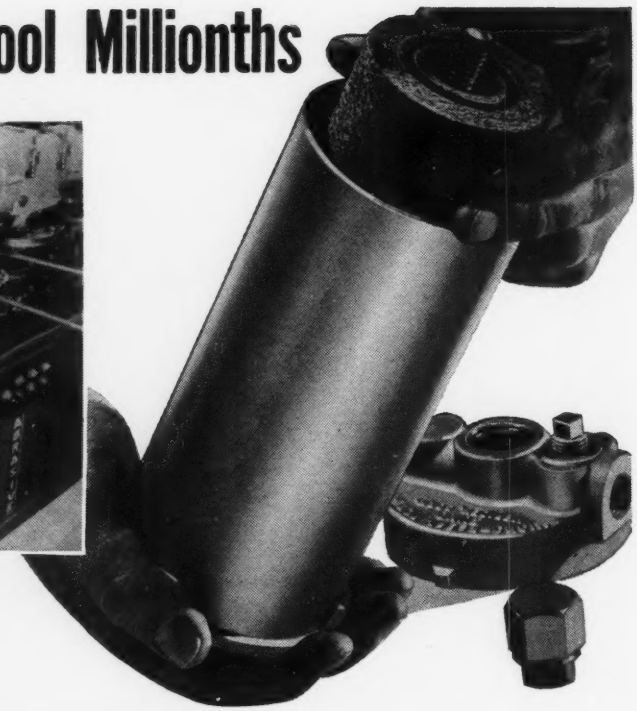
TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N.Y.

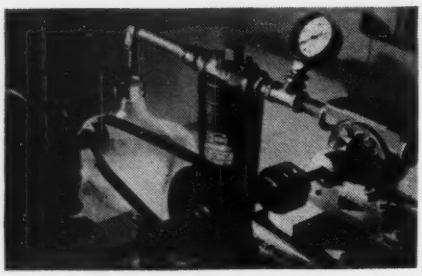
LUBRICATION — "ENGINEERED TO FIT THE JOB"

Making a Couple of Cool Millionths

Abrasive Carbide Finisher grinds tungsten carbide to less than 2 millionths of an inch root-mean-square roughness. Metal and abrasive particles which would damage work surface are removed from recirculating coolant by Cuno MICRO-KLEAN Filter.

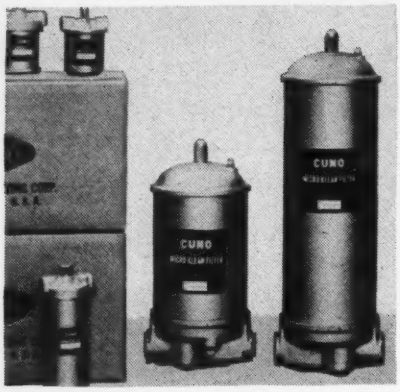






Handles wide range of fluids

In another application at Teaneck Chemical Co., Cuno MICRO-KLEAN with 25-micron cartridge handles 1-2 gpm of very viscous photographic chemical solution at 65 psi.

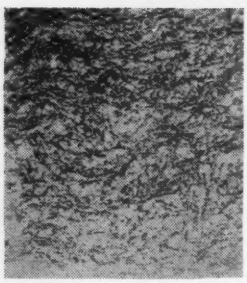


Cartridges...Filters...for all jobs

Cuno MICRO-KLEAN filters come in densities of 25 and 10 microns . . . capacities from a few to 850 gpm . . . connections from ⅜ in. IPS to 6 in. flanged . . . single or multiple cartridges to handle full flow. MICRO-KLEAN cartridges fit other makes; special lengths available for built-in installations.

Cuts cartridge replacement in half

Exclusive fibre construction of Cuno MICRO-KLEAN permits smaller particles to penetrate to varying depths. No surface-loading—graded-density-in-depth increases dirt capacity—doubles cartridge life. Resinous impregnation and polymerization bonds each fibre in position to prevent channeling, rupturing, shrinking and distortion.



● **Making the broadest line of fluid filters, Cuno is your best source for unbiased recommendations on any fluid filtration problem.**

Send Coupon for FREE Cartridge!

CUNO ENGINEERING CORPORATION
122 South Vine St., Meriden, Conn.

Please send information on Cuno MICRO-KLEAN for services checked.

- ☐ Lubricating Oil
- ☐ Hydraulic Oil
- ☐ Water and Water Solutions
- ☐ Compressed Air
- ☐ Fuel Oil
- ☐ Acids
- ☐ Any other_____
- ☐ Send free cartridge for installation in (filter make)

Name.....Title.....

Company.....

Address.....

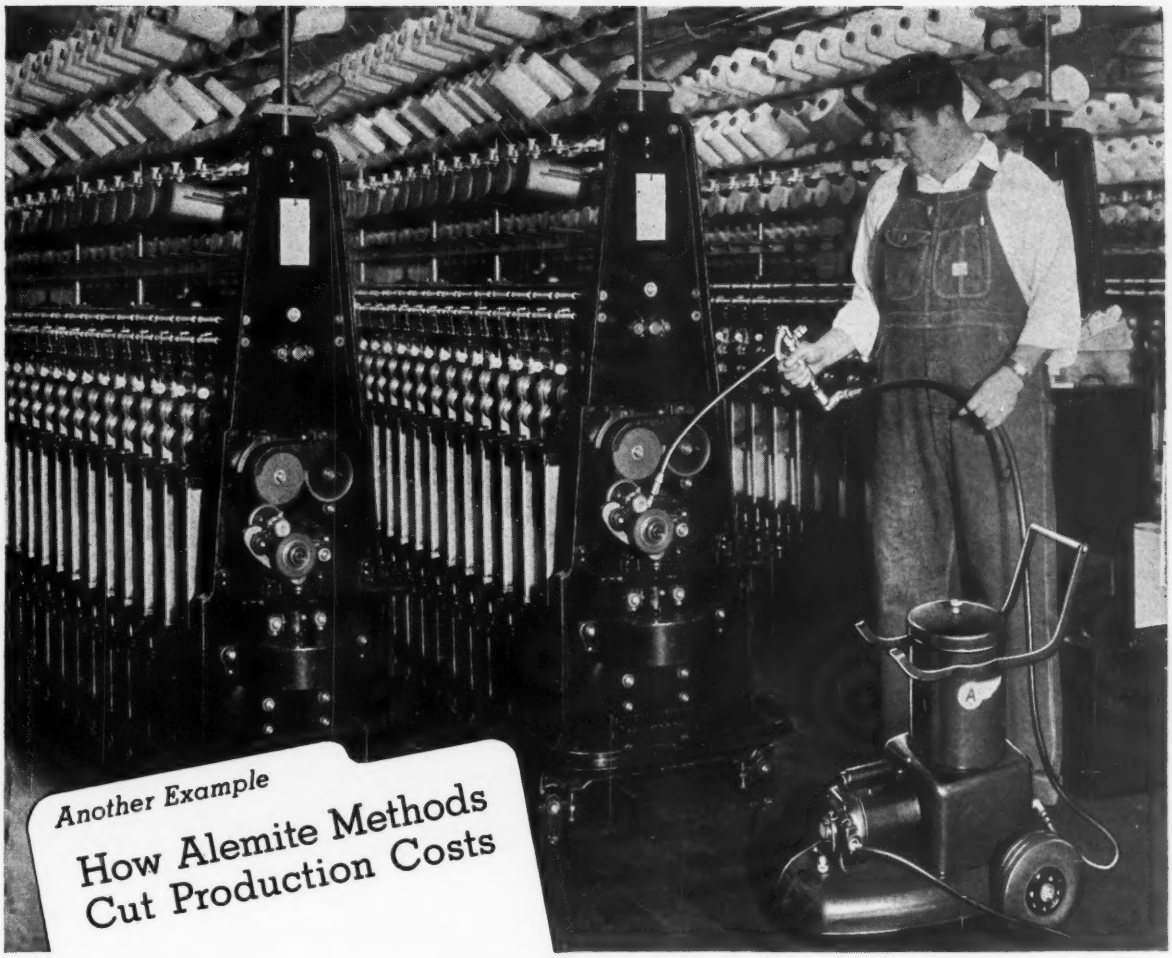
PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

CUNO

Fluid Conditioning

REMOVES MORE SIZES OF SOLIDS FROM MORE TYPES OF FLUIDS

Micronic . . . Disc-Type . . . Wire-Wound . . . Fabric Filter



Cuts "Time-Out" for Lubrication up to 64%

Increases Productive Time of Machines by Mechanizing the Handling and Application of Lubricants

Your Lubrication Methods May be More Antiquated Than You Suspect

If your oilers are still lubricating your machines by hand, bearing by bearing, you're losing manhours and cutting productive time of your machines. It's time to check up! The Alemite Representative is a specialist in modern methods of handling and applying lubricants. A five minute conference with him can easily show you new cost-cutting opportunities. Write to Alemite, 1847 Diversey Parkway, Chicago 14, Illinois. Call your Alemite jobber.

If you lubricate your machines with hand guns, here's news for you. By actual time-study, a new Alemite Method of power lubrication is 64% faster from barrel-to-bearing than the best hand grease gun methods. To say it another way—you can save up to 23.9 hours in applying each 100 pounds of grease!

It's the new 25 pound capacity Alemite Portable Electric Powergun. It's fast, it's positive, it develops 5000 lbs. grease pressure. And it helps add more productive time to machines . . . gives you extra hours to use for much needed preventive maintenance.

Just one of many ways that Alemite Methods help industry cut production costs through simplified lubrication procedures. The Alemite Representative can show you case after case where time-study analysis has proved that Alemite Methods reduce maintenance costs. These methods eliminate costly time-consuming handling of oils and greases . . . slash "time-out" for lubrication . . . keep dirt and moisture out of lubricants . . . completely mechanize lubrication from barrel-to-bearing . . . save grease. These benefits all add up to lower production costs. Get the complete facts, today.

ALEMITE

REG. U.S. PAT. OFF.

Another Product of STEWART WARNER

MODERN LUBRICATION METHODS THAT CUT PRODUCTION COSTS

Ask the Houghton Man about

HOUGHTON'S

plan for practical lubrication control to avoid danger of costly misapplication, and to include "fortified" oils and greases. This plan is a distinctive service rendered only on request. It is—

ENGINEERED

to specific plant needs. By that we mean that the Houghton lubrication engineer visits your plant and lists machines and lubricants required, making practical compromises to reduce the number of varieties recommended. You of course realize that—

LUBRICATION

is not a responsibility to be lightly regarded in any plant. Proper lubrication means increased production and longer life for expensive machines. Plants of all types have successfully adopted this—

PLAN

with the result of decreased oil inventories, less chance for error and lower over-all oil cost. The original survey is only the first step, as the plan follows through to assure efficient lubrication after its adoption. For details, write

E. F. HOUGHTON & CO.
Philadelphia 33, Pa.

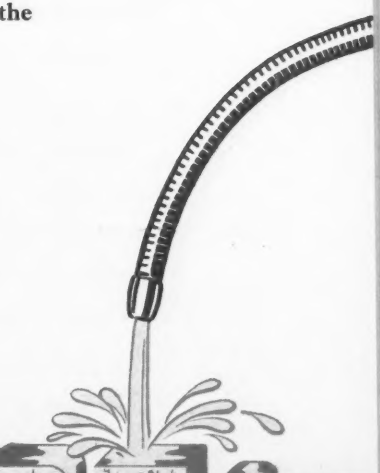
Easy to figure how CIMCOOL lowers metal cutting costs . . .

Cost figures show it in plant after plant. Cimcool—the revolutionary cutting fluid—this *chemical emulsion*—saves money three important ways.

1. **Longer Tool Life** (and therefore less down time) because of Cimcool's *chemical lubricity*.

2. **Faster Speeds** are possible because Cimcool cools faster, through a unique physical change in the cutting fluid itself. Tools and chips actually stay cool to the touch.

3. **Cimcool Costs Less** than old-fashioned cutting fluids because it lasts longer in the machine and reduces the cost of cleaning and changing machines. It isn't subject to rancidity. Its low surface tension and low adhesion to work and chips virtually eliminates carry off.



CIMCOOL DIVISION OF THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U. S. A.

CIMCOOL *for* 85%

Trade Mark Reg. U. S. Pat. Off.

OF ALL METAL CUTTING JOBS

In a maze of machinery?

Manzel Force Feed Lubricators penetrate the maze to force just enough of the right type of lubricant automatically to every point that requires lubrication.

Manzels save the initial cost many times over each year ...in labor, in oil consumption, and in longer lasting equipment on most of the leading engines, compressors, pumps, presses and other heavy machinery. Or they can be installed on your present equipment.

A Manzel engineer will gladly give you technical assistance on your lubrication problems. Write us now.

Manzel Inc. now supplies repair parts for all models of Bowser and Torrington Lubricators.

Builders of HIGH PRESSURE METERING PUMPS Since 1898

Manzel INC.

273 Babcock St.
Buffalo 10, N. Y.

Silicone News

DC SILICONES

DC 41 Silicone Grease Designed for Hot Spots

In the wheel bearings of the tunnel kiln cars at Alamo Pottery of San Antonio, Texas, even the most heat resistant organic greases were considered unsafe. Alamo engineers could have reduced the hazard by expensive redesigning but they found that DC 41 Silicone Grease provided a better and more economical solution.

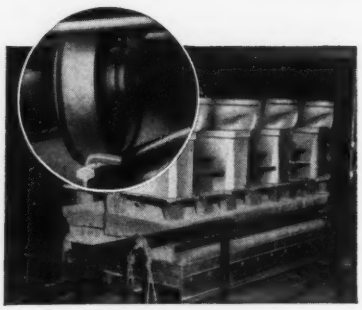


PHOTO COURTESY ALAMO POTTERY, INCORPORATED

DC 41 Silicone Grease in the roller bearings of tunnel kiln cars eliminates a fire hazard and reduces maintenance costs.

Vitreous china plumbing fixtures are baked by continuous process in a gas fired tunnel kiln. Alamo uses conventional sand seals to limit baking temperatures of 2300° F. to the central portion of the kiln. Even so, the kiln car wheel bearings are exposed to temperatures too high for organic greases. The best petroleum greases tested volatilized and presented a fire hazard. Bleeding was so extensive that it was necessary to relubricate the bearings every time a cart entered the oven.

At the suggestion of our sales engineers, Alamo tested DC 41 Silicone Grease. They have been using this semi-inorganic silicone grease for several months with excellent results. It makes the fire hazard negligible and it cuts relubrication from a daily to a monthly schedule.

Dow Corning Silicone Greases are being specified more and more frequently to solve lubrication problems because they possess low volatility, excellent heat resistance and good lubricity. For more information call our nearest branch office or write for data sheet D1-P.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

Atlanta • Chicago • Cleveland • Dallas
Los Angeles • New York
In Canada: Fiberglas Canada, Ltd., Toronto
In England: Albright and Wilson, Ltd., London

Dow Corning
FIRST IN SILICONES

THE EDITOR'S PAGE

THE ever increasing trend among the railroads to change to diesel locomotives has caused some alarm in certain quarters as to what an extension of this trend might mean to the future demands on petroleum. This is an interesting problem to investigate as an extension of these trends to the future brings out some striking results. At the present time, in spite of the extensive use of diesels, actually only one per cent of the national petroleum output is being consumed by such locomotives. Yet, the increase in diesel locomotives has been astounding. In 1940 there were less than 1,000 diesel locomotives; by the end of 1947 the number in use had passed 6,000, and the current rate of diesel locomotive production is in the neighborhood of 1,800 a year.

Three types of fuel are actively used in locomotives at the present time; coal for steam locomotives, heavy-fuel oil for steam locomotives, and light or diesel oil for diesel locomotives. The use of heavy or residual fuel oil is very extensive in certain parts of the west and south-west, and the tonnage of this residual fuel oil used far exceeds that which is used as diesel fuel. Based on 1000-ton miles of freight hauled; for each pound of diesel oil used in a locomotive, six pounds of heavy fuel oil would be required with an oil-fired steam locomotive and eleven pounds of coal would be required for a coal-fired steam locomotive. Based an passenger train car miles, the corresponding figures are 4.8 and 10. These figures show the thermal efficiency economies inherent in diesel over steam operation. However, they do not of themselves show an associated saving which enters the picture. This saving is concerned with the necessity of hauling fuel to various distribution points throughout the country so that it is available for the locomotives as needed. This much greater consumption of fuel for steam operated locomotives ties up thousands of coal and tank cars merely for hauling fuel from point to point and to this large investment of additional cars tied up in fuel haulage must be added the extra power and fuel required for these distribution trains. Thus, for every oil-fired steam locomotive replaced by diesel, only 1/6th as much fuel must be hauled around the country and for every coal-fired locomotive, only 1/10th as much fuel must be hauled around the country.

As additional diesels go into service, more of the equipment tied up for handling fuel will be released for other services, and more and more quickly will operating costs be reduced. Only time will tell accurately where diesel fuel demands, on petroleum resources, will go. If we should assume the most extensive growth in this direction, it seems unlikely that more than 3 to 5 per cent of our petroleum supply could be consumed, and there seems to be no question that this result can be obtained at over-all economies of national wealth and resources. The picture of the gas turbine, however, is beginning to show itself as a possible competitor to the diesel. The time may still be several years off, but this type of power will definitely be heard from. In the interests of all around national prosperity, may the best locomotive horse win the race!

In lighter vein, it is our pleasure to present this month the "Friction Finch."

Scientists have been engaged for years in the endeavor to depict, by the use of charts and graphs, the causes and effects of FRICTION.

Lubrication Engineers are ever alert to its devastating effects and are constantly standing by with remedies.

It fell to the lot of Dr. Seuss, widely known author and illustrator, to give us the first authentic portrait of the Friction Finch. Armed only with a grease gun, Dr. Seuss tracked down this vicious creature, using a series of cleverly constructed magnets on the powdered metal tracks. One shot felled the bird but not before his likeness was transferred to paper. The species is not extinct and constantly lies in wait for the dry bearing and all moving parts.

FRICTION FINCH

The Lubrication Engineer's Nightmare

Courtesy New Departure Ball Bearings

Dr. Seuss comments as follows:

"The Friction Finch, of course you know,
Is mighty mean. He loves to go
To places where machinery whirrs
And frustrate man-u-fact-u-rers
By bearing down on shafts and wheels
With his abrasive toes and heels,
Which rub, and rub, and rub, and rub
And rub away your profits, Bub."

Antifriction Bearing Developments*

By A. STEWART MURRAY

S.K.F. Industries, Inc.

Mr. Murray received his Degree in Mechanical Engineering from the Carnegie Institute of Technology, and in 1934 joined SKF Industries, Inc., as Assistant Division Engineer. He was promoted to Senior Division Engineer of the Steel Mill Division and occupied that position from 1936 to 1943. He has been active in the application and design of bearings for rolling mills in this country and abroad. In 1943 he became Assistant Chief Engineer of the company and broadened his interest to cover all of the bearing using industries. The material in his paper is built on this extensive background.

ABSTRACT

Two new phases of lubrication are each quite the opposite of the other. A proper application for mist lubrication makes it possible to use oil where both grease and oil have given trouble when conventional methods are employed. Flood lubrication permits the use of rolling element bearings with superior performance at speeds and temperatures difficult for other bearings.

DESPITE the ever-present risk of being wrong when starting with an assumption, I am happily assuming that you have all been exposed to routine discussions on ball and roller bearing lubrication. For your consideration I am going to outline in only moderate detail two new phases of lubrication and discuss some significant points as they apply to each phase.

In a paper entitled: "Friction Torque in Ball and Roller Bearings,"[1] Dr. Haakon Styri showed curves, Fig. 1, illustrating the decrease in the torque of ball bearings. These curves show that the greatest change in net torque, for three different types of 70 mm. bore ball bearings, occurred with the decrease in quantity of oil from several drops per minute to one drop per hour. The torque continued to decrease perceptibly until the rate was reduced to one drop per bearing per four hours. These bearings were all running at 1800 rpm. The two radial types were each sustaining loads of 1000 lb and the pure thrust type had a 500 lb load.

It is quite evident that an oil film can be allowed to become extremely thin, but, it must be unbroken everywhere there is a rolling or rubbing contact. Each year thousands and thousands of grease lubricated ball bearings are destroyed due to inadequate lubrication simply because the more than adequate amount of oil present in the grease within the bearing chambers was unfavorably distributed and not available to the bearings where and when they needed it. And yet, design, maintenance and application limitations may make the lubrication alternatives of drop feed, static, and circulating oil dangerous, unattractive or impractical. To these older possibilities there is now available the new alternative of Oil Mist Lubrication.

The S.K.F. Oil Mist Lubricator of Fig. 2 has a ¼-HP motor-compressor unit mounted on a common base with the Lubricator. Air at 15 to 20 psi gauge pressure is delivered through a pipe, Part 7, to the Lubricator. The compressor is protected from overload by a relief valve that can be set for 25 psi maximum. A small part

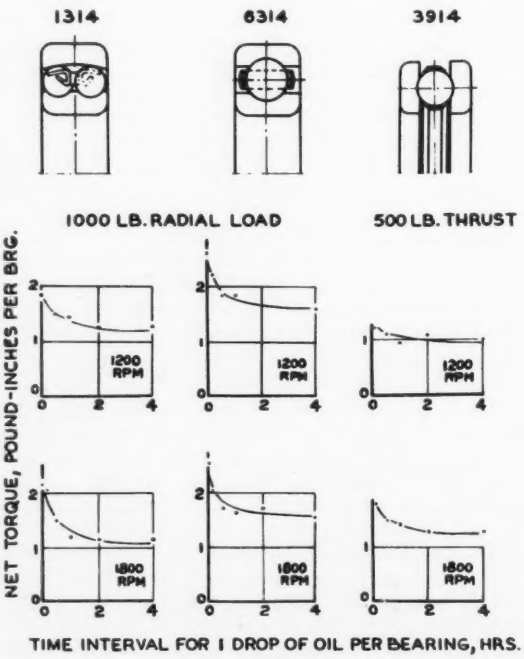


FIGURE 1 - THE EFFECT OF RATE OF OIL FEED ON RUNNING TORQUE OF 70 MM. BORE BALL BEARINGS.

* Presented at the Third Annual Convention of A.S.L.E. at Buffalo, N. Y., April 20, 1948.

[1] American Society of Mechanical Engineers, New York City, December, 1940.

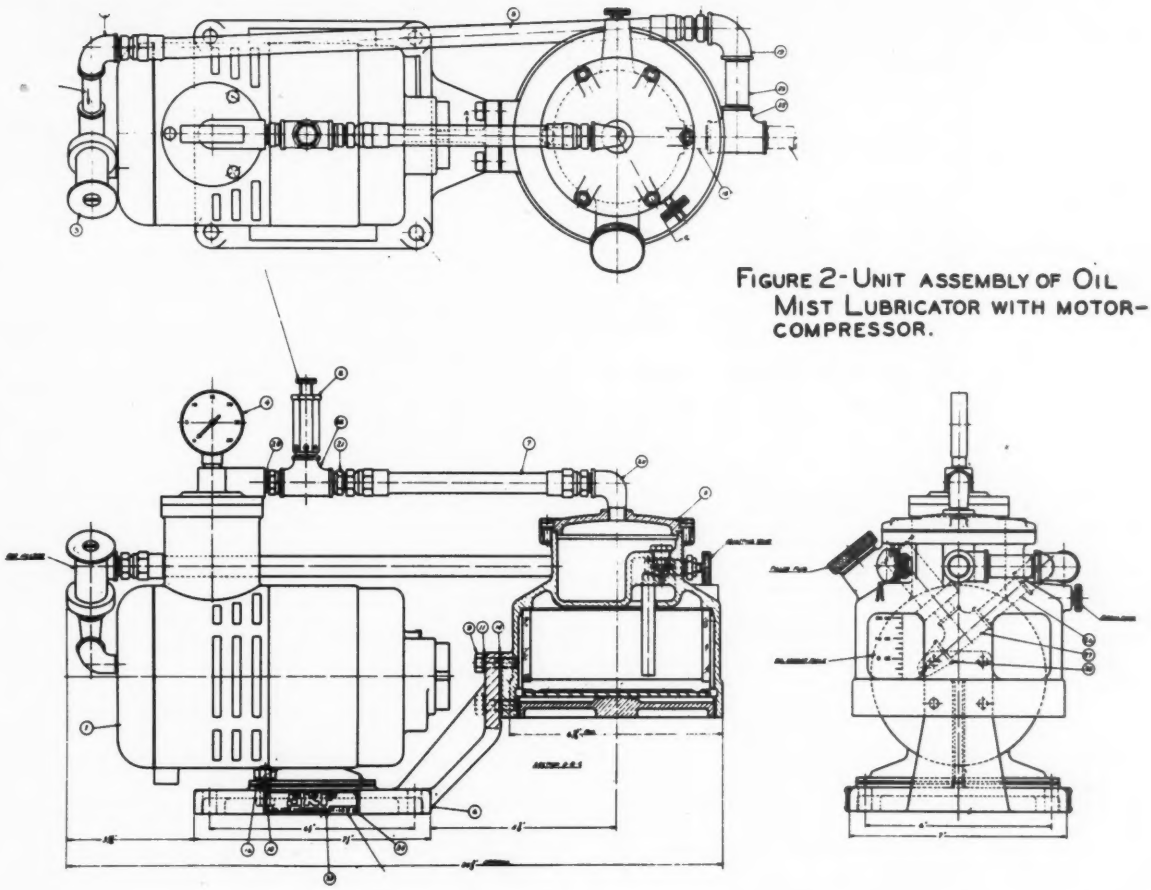


FIGURE 2-UNIT ASSEMBLY OF OIL MIST LUBRICATOR WITH MOTOR-COMPRESSOR.

of the air that has been compressed and expanded to absorb oil mist, is recirculated through the compressor to lubricate the floating rotor and vanes. This simplifies the maintenance of the compressor and improves its lubrication.

The lubricator develops oil mist by passing air through a small orifice and expanding it into a chamber connected to the oil reservoir through an adjusting valve. Expansion of the air in the chamber creates a pressure drop sufficient to draw oil up through the suction tube that may be seen extending nearly to the bottom of the reservoir. The high velocity of the air stream overcomes the surface tension of the oil and breaks it up into a fine mist. The stream of air, plus the mist that has just been entrained, is directed downward against a baffle in the chamber just below the orifice, and thus removes the large particles of oil. The mist that leaves this chamber is in a finely divided state and sufficiently stable to carry reasonably long distances through connecting lines without separating out and collecting in pockets.

The Lubricator is supplied with approximately 2CFM of free air and is capable of converting into mist approximately 1 cu in. of oil an hour. Oils of SAE 10 to SAE 30 are usually employed, and it is desirable to select a slightly higher viscosity than would have been chosen if the particular application were being lubricated with a more ample supply of oil.

If a specific ball bearing application may be lubricated with 20 drops of oil per hour, or less, then it is practical to consider the use of the Oil Mist System. This principle is particularly well suited to high-speed installations where the temperature rise must be kept to a minimum as a means of helping to satisfy accuracy requirements. It is quite common to observe a 10 to 25° F lower temperature rise after installing an Oil Mist Lubricator on an existing machine. This temperature reduction is accomplished principally through the complete elimination of oil churning; the cooling effect of the air is rather small.

Oil Mist Lubrication reduces maintenance costs and gives increased machine reliability and availability for a number of different reasons. In high speed grinding spindles non-rubbing seals are necessary and the outward counterflow of air is a very effective help towards excluding such foreign matter as abrasive matter and coolant. The cleanliness of bearings running at high speeds is absolutely essential to longer bearing life and such increases in grinding spindles have been from a few hundred hours before Oil Mist Lubrication to several thousand hours after its adoption. We have successfully employed oil mist for spindle bearings, 15 mm. in bore, running at 50,000 rpm.

Another grinding spindle bearing application illustrates the practical value of Oil Mist Lubrication in the solution of typical routine problems. Several of our larger surface grinders have vertical spindles whose designs differ in that some were built for oil lubrication, others for grease. The seals are not very effective in their retention of lubricant, with the result that so long as the spindles were faithfully lubricated in accordance with the prescribed schedule, good bearing life resulted. However, the human element made the actual bearing life erratic and unsatisfactory from our point of view,

and so we equipped one surface grinder of each type for Oil Mist Lubrication. The bearing life has become very satisfactory, and the reliability and availability of the machines are quite pleasing to the Production Department.

Oil Mist Lubrication by virtue of its very design eliminates several of the different normal ways in which dirt gains entrance to the bearing chamber. As mentioned previously, it prevents the entrance of foreign matter through the seals and it eliminates the dirt that would be put into the bearing chamber in the act of lubricating. Furthermore, the dirt in the apparently clean oil with which we fill the reservoir of the lubricator never reaches the bearings because it is left behind to accumulate in the bottom of the reservoir which must be cleaned out from time to time.

There are other features of the Oil Mist Lubricator of incidental interest. It can serve fifteen to twenty bearings through a minimum of piping that generally represents a considerable simplification. For example, two bearings in a common chamber will usually have separate lines if drip feed lubrication is employed, whereas Oil Mist Lubrication requires only a single line. In addition to its being possible, it is also much easier to determine whether a bearing is receiving lubrication from an Oil Mist System. When a machine is not running a faint vapor is visible as it escapes through non-rubbing seals. This evidence of oil mist disapperas completely with the slightest windage from rotating parts.

We do not look upon the Oil Mist Lubricator as a panacea but rather as another specialized tool with a wide scope of application.

There are many bearings to which minute quantities of oil may be properly supplied for most effective results. There is another group of application problems for which a flood of oil, not a film, is the solution. High speed spindles for turning magnesium and aluminum, and the rotor shafts of airplane gas turbines are typical

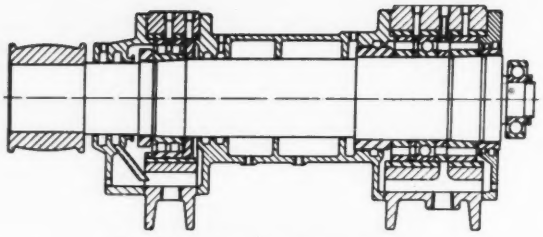


FIGURE 3-TEST SPINDLE FOR DETERMINING EFFECT OF VARIATIONS IN OIL FLOW AND BEARING LOAD ON POWER CONSUMPTION AND INDIVIDUAL BEARING TEMPERATURE.

of this new and expanding field of bearing mountings using large volumes of oil for lubrication.

Fig. 3 shows a spindle that we have used for investigating ball and roller bearings under radial loads and thrust loads at speeds up to 10,000 rpm. The double row cylindrical roller bearing NN 3018 KM (3.543" bore) and the angular contact bearing 7020 (3.937" bore) are loaded by the 6309 deep groove ball bearing at the right hand end. This last mentioned bearing is one of a heavier series, and, because of its relatively small bore (1.772"), the load and speed to which it is subjected in order to load the test bearings do not stress it so severely.

With this spindle we have accumulated a vast amount of data concerning the operation of relatively large bearings of the rolling element type for speeds of approximately 10,000 rpm at thrust and radial loads up to 2400 lb each. I am only going to attempt to give a sense of proportion by reviewing some of the results. In Fig. 4 we see the effectiveness of oil in large volume. The working load applied to a 6309 bearing at the right hand end of the spindle had a thrust component of 800 lb and a radial component of 400 lb, the spindle was running at 9700 rpm, and the incoming oil temperature was 30C. An increase in oil flow through each bearing from one

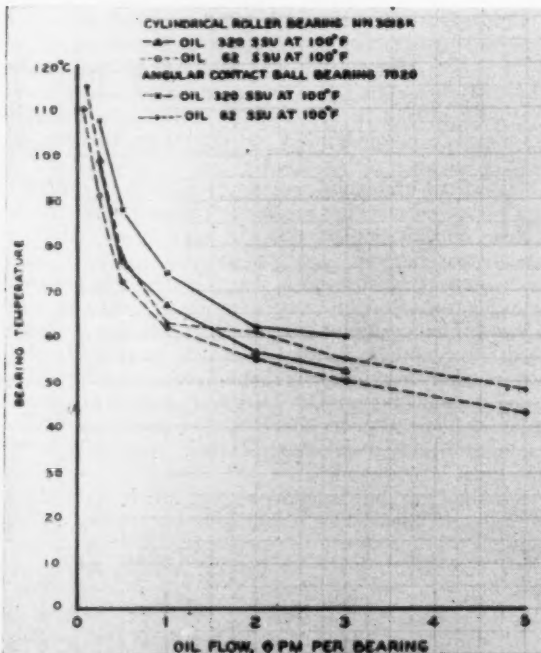


FIGURE 4-BEARING TEMPERATURE IN RELATION TO OIL FLOW PER BEARING IN SPINDLE FIG. 3

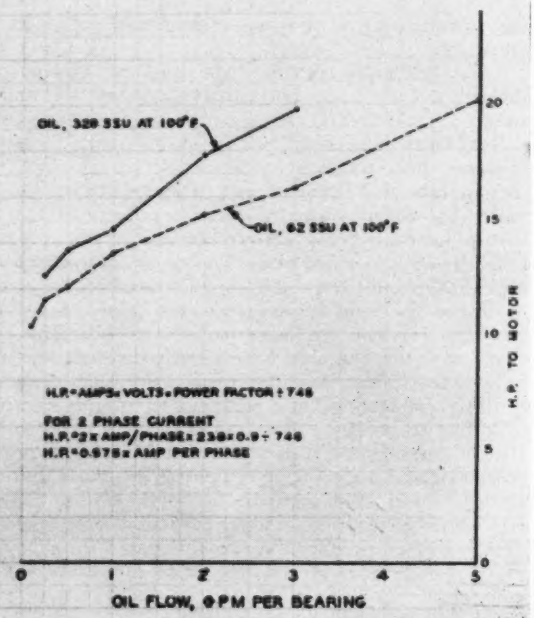


FIGURE 5-TOTAL HORSEPOWER INPUT TO MOTOR, DRIVING SPINDLE (FIG. 3) THROUGH A SPEED-UP JACKSHAFT IN RELATION TO OIL FLOW PER BEARING.

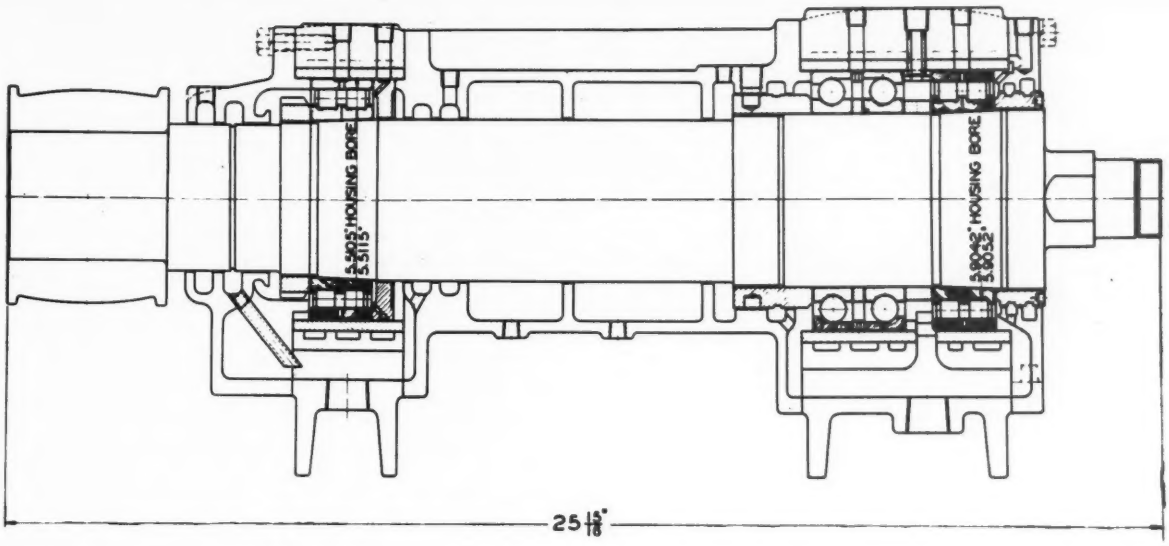


FIGURE 6-EXPERIMENTAL HIGH SPEED LATHE SPINDLE

pint to five gallons per minute decreased the total temperature of the spindle bearings from a maximum of 115 C to a maximum of 48C.

The curves in Fig. 5 show the total horsepower required to drive the spindle under the conditions of Fig. 4. As would be expected, the power required increased almost linearly with the increasing flow of oil. Also, the higher viscosity oil required the greater amount of horsepower, and, for a given rate of flow, it produced a higher bearing temperature. Oils with the higher viscosities must be considered because an unbroken oil film must be maintained, and too low a viscosity will not adequately lubricate even though present in large volume.

Since Fig. 5 indirectly indicates the power lost due to churning of oil by rolling element bearings, it might be concluded that such bearings obviously should not be used but instead oil film bearings should be selected. Such a conclusion is positively contradicted by the facts.

Dr. R. L. Templin of the Aluminum Company of America presented a paper[2] entitled: "Development of a High Speed Lathe for Machining Aluminums." This lathe that Dr. Templin developed used oil film bearings in the spindle and as a unit is directly comparable to the spindle, Fig. 6. That the two spindles are directly comparable is not accidental. We actually did plan it that way.

Dr. Templin stated that extrapolation of his data indicated that the oil film bearing spindle and its direct-connected oil film bearing motor, could be expected to draw 56hp at 9000 rpm when running idle. The use of light oil indicated that this power consumption could be reduced by 17% through the use of a lighter oil. (This lighter oil was 63 instead of 107 SSU at 100 F).

The spindle, Fig. 6, was driven by an 1800 rpm motor through a jackshaft, and both the motor and the jackshaft were mounted on ball bearings. When running at 10,000 rpm with 200 lb of thrust load and 225 lb of radial load applied to the chucking end, the spindle drew only a comparable 24 hp when passing two gallons of DTE Heavy Medium Oil (320 SSU at 100 F) through each bearing location. The four oil film bearings required an additional 22½ to 32 hp for bearing friction only, at 1000 rpm slower and without any load on the spindle, as compared to nine rolling-element bearings in our spindle and its drive. As a matter of incidental interest, but of major importance, this comparison of the two spindles shows the fallacy of using coefficients of friction and emphasizes the necessity of using friction torque for power loss if reliability of the calculations is important.

There are medium and low speed applications using oil in volume not just for lubrication but principally for the cooling that makes the difference between reliable bearing performance and continuous trouble. The hollow rolls used in the paper and plastic industries are supplied steam at temperatures of 25° to 350 F and the bearings give trouble if the lubricating oil reaches these temperatures. Flooding clean cool oil through the bearings, preferably by jetting, so as to impinge on the inner raceways, prevents the oil actually lubricating the surface contacts from reaching a carbonizing temperature. Usually the rolling-element bearings for such equipment in these industries are of the roller type and they have characteristics that make them suitable for such applications. The actual width of contact with the hot journal is only a fraction of the plain bearing alternative, and the appreciable space between the inner and outer races permits a practically unrestricted rate of flow of cooling oil without regard to how slow or fast the bearings are rotating.

The mounting, Fig. 7, illustrates one of the methods of jetting oil into a bearing for effective cooling. In this case, a 4-High Cold Rolling Mill, the heavy load and fairly high speed would make the bearings run hot without a system to supply 1 to 1½ gallons per bearing per minute of cool oil to the rolling and rubbing contacts. A continuous and complete drainage of oil in the bearing

[2] American Society of Mechanical Engineers, Atlantic City, December, 1947.

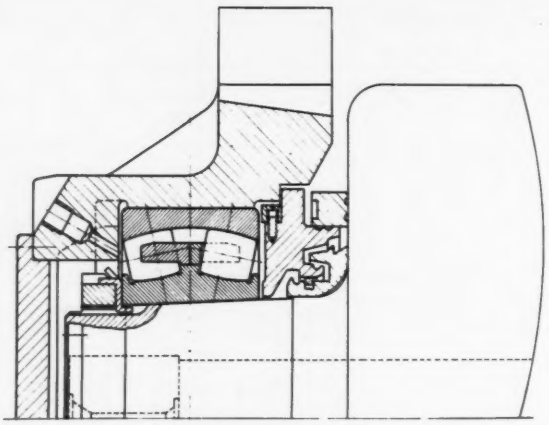


FIGURE 7 - STECKEL COLD MILL BACK-UP ROLL NECK BEARING MOUNTING DESIGNED FOR OIL JET LUBRICATION AND COMPLETE OIL DRAINAGE.

chambers prevents additional heat from churning and any marked tendency toward frothing of the oil.

The application of bearings that is having trouble honestly due to lubrication, can reasonably be corrected. As it is frequently in such comforting statements as the preceding, there may be a joker, and in such cases it will probably be the cost. Often the problem is essentially prejudice and resistance to change when trying to improve new machines.

ANTIFRICTION BEARING DEVELOPMENTS

Discussion by T. E. ROUNDS*

Mr. Murray's discussion of the two conflicting or opposing types of oil lubrication systems is well developed and quite clear. However, a few points perhaps should be emphasized more strongly.

With regard to air-oil mist lubrication, the basic principles are excellent and have been used for a number of years. Whether oil is made into a mist by an impeller, by atomizer or by other means, finely divided oil is the most practical method of lubricating very high speed bearings of the smaller sizes. By this I mean very high speed installations such as on grinding spindles—turbo blower applications and others. Space, weight and expense factors usually militate against quantity flood lubrication of such installations and oil churning is most severe due to restricted space factors.

With the advent of using air to atomize the oil it was soon found that many high speed units ran much cooler, sometimes as much as 30 to 40 F. We are inclined to disagree with Mr. Murray's statement that temperature reduction is accomplished primarily through the complete elimination of oil churning and that the cooling effect of the air is rather small. Our experience indicates that the chief reduction in temperature is due to the cooling effect of the air. Drip feed systems using the same small rates of feed, but with no air applied definitely ran with higher temperatures.

We have successfully run No. 203 size spindle bearings at speeds up to 67,000 rpm and furthermore the No. 200 size up to speeds of 80,000 to 100,000 rpm. Miniature series bearings have been operated successfully with air-oil mist at speeds as high as 145,000 rpm.

While the lubrication of very high speed bearings with combined air and oil mist seems to be the best answer to the problem it is not the complete answer unless certain precautions are taken. Adequate air filters are very necessary as close as possible to each spindle and all piping between the lubricator and the spindle must be of a type susceptible of complete cleaning for absence of scale, dirt and other contaminants.

Air-oil mist systems using the Norgren lubricator have been so successful that we have operated 203 duplex spindle bearings, preloaded, two pairs per spindle at preloads as high as 50 lb at speeds in excess of 50,000 rpm. Such bearings grease or oil drip lubricated without air soon failed due to the development of excessive heating and resultant internal overstressing of the balls and raceways.

In considering the use of air-oil mist, the following points should be carefully considered:

1. The conditions must be sufficiently severe to justify the cost of installation as well as of the air and oil consumed.
2. The air-oil mist supply must be clean.
3. The quantity of oil and air used must be determined by careful experimentation. Excessively rich oil mixtures are wasteful and excessively lean mixtures may promote early failure.
4. The air supply should be left on after the spindle is stopped until the housing and spindle parts have cooled to room temperature. If this is not done, foreign matter and coolant may be drawn into the spindle housing due to contraction of the air within the housing and later cause failure when the spindle is restarted.

Referring to those larger size spindle installations where air-oil systems are not adequate, it appears that considerable power is consumed by the bearings largely due to churning of the heavy flow of cooling oil. It is quite evident from Mr. Murray's statements that antifriction bearing spindles consume less power than do plain bearing spindles of similar size, but could not the power consumption be reduced even further by refrigerating or cooling the oil supply.

Adequate refrigeration should consume little power and modern units are quite reliable as far as temperature regulation is concerned. In Fig. 4, we note that bearing temperatures, even with heavy oil flows, reached a minimum of 40 C. From Fig. 5, we note that the power consumption however has approximately doubled (an increase of 10 to 20 horsepower) to achieve this minimum temperature. By reasonable refrigeration of the oil supply, it should be possible to reduce these temperatures considerably and pump less oil with less overall power consumption. Cooler bearings should indicate longer bearing life and result in the maintenance of greater accuracy of work.

Such systems of refrigeration may or may not be practical for steel mill roll neck bearings but such systems should be practical for machine tool spindles where there seems to be a definite advantage in using reduced coolant temperatures as evidenced by longer tool life and better accuracy. Will not combined refrigeration units for cooling both lubricant and coolant be the final answer where flood cooling of bearings and work are a necessity?

With regard to grease lubrication of high speed bearings, there are many successful installations now running. One prominent manufacturer is operating No. 202 size spindle bearings on a vertical installation at 45,000 to 50,000 rpm. However, by an ingenious system, the quantity of oil bled from the grease into each bearing is carefully controlled so that under no circumstances is

(*Continued on page* 274)

* Chief Engineer, The Barden Corporation, Danbury, Conn.

The Significance of Chemical Tests to Consumers of Lubricants*

By WILLIAM EISMANN, Jr.
Supervisor, Lubrication Research, E. F. Houghton & Co.

THE prospective and regular purchasers and users as well as the suppliers of lubricants are constantly faced with lengthy specifications supplied by manufacturers or requested by consumers. What do they mean and why are they so lengthy?

Lubricant specifications are often lengthy because they may cover products which can be used to lubricate many types of machinery and the manufacturer has guaranteed limits which will cover requirements for several usages. In other instances, the lubricant has been designed to operate in a single mechanism of a complex nature in which better than average lubricating qualities are essential.

The tests covered by these specifications are of four principal types: physical, chemical, the combination of physical and chemical tests, and performance tests. While this paper will limit itself to a discussion of those tests of a chemical nature, it must be remembered that individual tests are likely to be misleading and the whole picture, including physical and performance tests, must be considered when attempting to evaluate lubricants.

Chemical Tests on Lubricating Oils

1. *Saponification Number.* The saponification number of an oil is the number of milligrams of potassium hydroxide required to saponify one gram of the oil. It measures the quantity of neutral fats and fatty acids present. Its principal value to the consumer is in the purchase of compounded oils, which contain percentages of fatty oil or fatty acid. Once the saponification number for an oil containing fats or fatty acids has been established, the consumer, by checking the saponification number of subsequent deliveries, can calculate the percentage of fats and fatty acids present and thus determine the uniformity of shipments in this respect and make certain that the correct material has been received.

Saponification number is of little value in analyzing used oils because the formation of mineral acidity, organic acidity or metallic soaps will give misleading values. For the same reason, it is of little value in testing new or used oils containing added sulphur, chlorine and phosphorus compounds, or oils treated with rust preventives, detergents, or extreme-pressure additives, since these additives often enter into the reaction thereby giving false saponification numbers.

2. *Neutralization Number.* The neutralization number is the number of milligrams of potassium hydroxide required to neutralize the acidity in one gram of the oil. It represents the total quantity of both mineral and organic acidity present. If the oil to be tested is alkaline, one gram of the oil is neutralized with standard acid solution. Then the neutralization number is the number of milligrams of potassium hydroxide necessary to neutralize the quantity of acid which has been used.

Saponification number involves cooking the oil with a solution of alcoholic potassium hydroxide and back titrating with acid. In this method, fatty oils which are usually glycerides of fatty acids are saponified by the alkali in addition to any acidic materials which may be present. In running a neutralization number, only the acidic materials present as organic or inorganic acids are neutralized by the alkali.

All mineral oils, even those which are most thoroughly refined, have at least a small neutralization number. These acid compounds come from organic constituents found in the crude petroleum or, in some instances, from the chemical treatment given an oil in the course of its refining. The neutralization number of refined mineral oil usually will run from a trace to 0.1. Higher neutralization numbers are usually obtained in oils containing additives as the titration of these products often includes reaction between the additives and the titrating medium.

Neutralization number can be used as one of the inspection tests on new oils but the greatest application for this test is for use in indicating the amount of deterioration due to breakdown of used oil. This is particularly true in the testing of hydraulic oils, transformer oils, turbine oils, motor oils and diesel lubricants. In the last two items, the presence of additives in the oil or contamination from combustion products may affect the results. The rate of increase in neutralization number of an oil in service has often been used as a means of determining the extent to which the oil is breaking down. Limits can be set up which will indicate the point at which the oil should be drained and replaced with fresh material.

3. *Dilution of Crankcase Oil.* In internal combustion engines, unburned portions of fuel may get into the crankcase. This contamination is known as crankcase dilution. When present in excessive amounts, it may be harmful to the lubricating oil by lowering the viscosity of the oil to such an extent that it may cause breakdown of the lubricating film. The test is run by boiling a sample of the diluted oil with water which vaporizes the volatile fuel in the oil with the steam which is then condensed and the volatile material separated. This type of dilution is an indication of the operating temperature of the engine. In some cases, it is also a measure of the quality of the fuel and/or the mechanical condition of the piston rings and cylinders.

A high percentage of dilution will so reduce the viscosity of the oil that excess wear of moving parts may occur. Excessively diluted oil means that the engine is running "too cold" and steps should be taken to raise water jacket temperatures. Excessive idling also may be the reason for excessive dilution. Further causes of excessive crankcase dilution may be:

(1) Worn or warped pistons
(2) Worn or warped rings and cylinders
(3) Dimensionally inaccurate rings.

* Paper presented at 3rd Annual Convention of A.S.L.E., Buffalo, N. Y., April 21, 1948.

Any of these conditions can permit blow-by and cause fuel to make its way from combustion chambers to crankcase. A high percentage of dilution can also be caused by an excessive amount of high boiling point constituents in the fuel.

For a comprehensive discussion of the practical significance of crankcase dilution, it is suggested that reference should be made to the A.S.T.M. Publication, "Symposium on Motor Lubrication." [1]

4. *Precipitation Number.* The precipitation number of an oil is that precentage of material which is insoluble in a petroleum naphtha of specified properties after the mixture of oil and naphtha have been centrifuged.

In new oil, the precipitated matter is called tar or asphalts. The names tar or asphalt have become attached by common usage to those constituents of oil which originally are in the crude petroleum and, as a result of the distillation of the crude petroleum, are concentrated in the residual products. They should not be confused with commercial tar or asphalt.

Highly refined oils have lower precipitation numbers than oils not highly refined. As a general rule, oils of light viscosity have very low or no precipitation number.

In used oils, the sediment obtained after determining the precipitation number may contain water, dirt, metallic particles or other materials insoluble in the solvent. This test can, therefore, be used as a means of measuring the effectiveness of a filtering system or determining the point at which a crankcase, sump or reservoir is in need of a thorough cleaning in order to prevent wear on moving parts in the lubricating system.

5. *Ash Content.* The ash content of an oil determines the quantity of non-combustible material present. These items are usually siliceous materials (dirt, sand, etc.), metallic compounds or abraded metals. The ash content is obtained by burning a weighed quantity of oil, igniting and weighing the ash, taking care to avoid mechanical losses throughout the test.

Refined oils contain very little or no ash unless they have been treated with additives containing metallic constituents. This test is of greater importance when analyzing used oils, as compared to new oils. It can be used as a quick method of measuring the loss of additives when it is known that the fresh oil contained a definite amount of ash-forming material. It is also used as the basic step toward qualitatively or quantitatively determining the type and amount of certain impurities present in used oil as a result of contamination.

6. *Carbon Residue.* When an oil is vaporized and burned in the absence of air, it leaves a residue which is called carbon residue.

Generally speaking, heavy oils have higher carbon residues than oils of light viscosity. However, due to the fact that petroleum products are mixtures of many compounds differing widely in their physical and chemical properties, two oils having a similar viscosity can also vary considerably with respect to the amount and type of carbon obtained with this test.

Oils containing ash-forming additives will naturally show higher carbon residues than untreated oils. Likewise, used oils containing contaminants previously mentioned will give misleading results when subjected to this test.

The test was originally designed to predict the amount of carbon which could be expected to form when an oil was subjected to high temperatures. This prediction may be made if full consideration is given to factors which may have an effect upon the results obtained in service. Factors which will have a marked effect upon the amount of carbon deposited by an oil in an internal combustion engine are viscosity of the oil, the oxidation susceptibility of the oil, the mechanical condition of the engine, cleanliness of the intake and fuel carburetion conditions.

Some consumers have found this test useful in assisting to predict the performance of oils used to lubricate conveyor systems operating at high temperatures.

7. *Corrosion Tests.* Corrosion tests are accelerated tests used to establish the potential corrosivity of a lubricant. Nearly all petroleum products contain sulfur, even after the oil has been subjected to the various refining processes. This sulfur is present in many different chemical forms. Many lubricating oils also contain sulfur or sulfur compounds which have been added by the supplier for a definite reason. Oxidation inhibitors, rust preventive compounds, corrosion inhibitors and detergents may all contain sulfur. Modern lubricants may also contain added chlorine, phosphorus, nitrogen or metallic compounds. To make the problem more complicated, modern machinery is no longer made from just steel and there are any number of combinations of metals which may come in contact with the lubricant. Higher operating temperatures further complicate the problem.

In giving consideration as to the proper choice of lubricant from the standpoint of corrosion, the following factors should be studied:

(1) What metals will be in contact with the lubricant?

(2) What will be the maximum operating temperature?

(3) Will air and/or moisture travel through the system?

The simplest and shortest corrosion test of all is the one involving a test period of 3 hours at 212°F which has been adopted by the U. S. Government for determining the corrosive properties of lubricating oils. A polished copper strip is usually used.

In those instances where lubrication of a mechanism involves the presence of more than one metal, together with heat and presence of air and water, it is necessary to take all of those factors into consideration before deciding what type of corrosion test should be adopted.

Correct interpretation of corrosion test results also deserves consideration. Many lubricants which may tend to discolor metals are quite satisfactory for the job for which they are intended. A bright reddish stain is often obtained on copper if fatty oils are present. In other cases, faint multi-colored stains commonly called "peacock stains" are often obtained on copper. In some instances, certain steels will show a light blue stain.

The corrosion to watch for is the type which gives dark brown or black stains, visible pitting of the metals, etching and visible loss of metal. Some specifications include a measurement of loss or gain in weight of the metallic specimens. With respect to this modification, it is often advantageous to check specimens for loss in weight if they come out of the test in a very clean and

[1] M. A. Dietrich, "Service Changes in Crankcase Lubricating Oils," Symposium on Motor Lubricants, New York Regional Meeting, A.S.T.M., p. 57 (1933).

Mr. Eismann received his B. S. degree at the University of Wisconsin. He then became affiliated with the Pure Oil Company Laboratories in Chicago, later transferring to their Marcus Hook Laboratory, where he specialized on greases. Mr. Eismann joined E. F. Houghton & Co. in 1937, becoming Supervisor of Lubrication Research in 1940. Since 1946 he has been in charge of the Rust Preventive Laboratory.

Mr. Eismann is a member of the N.L.G.I. and the A.S.L.E.

bright condition as this may be indicative of attack by inorganic or organic acids. Zinc and copper are two of the metals which brighten upon attack.

In designing a corrosion test for a specific problem, care must be taken in selecting the temperature at which the test will be run. The proper temperature should be high enough to give considerable acceleration, thereby reducing the time required for the test but not too much higher than the maximum temperature to which the lubricant will be exposed. If the test temperature is set too high, breakdown of the oil and corrosion of the metal may occur in the test procedure which may not occur in actual operation.

Corrosion tests have also been used to measure "controlled activity" of certain lubricants, particularly hypoid lubricants. The term "controlled activity" is used to describe a condition where the required properties of the lubricant are such that, under severe operating conditions, the additives must be reactive enough to carry the load. Under less severe conditions, chemical reactivity must be absent. The "Copper Strip Test" as specified by General Motors Corp., wherein the reactivity of the lubricant is negative at 210°F, but is positive at 300°F, is an example of this use of this test.

8. *Oxidation Tests.* All lubricating oils deteriorate in service. The rate and extent to which this occurs determines the "life expectancy" of the oil. When deterioration does occur, it is generally accompanied by oxidation and the formation of oxidation products. This is the most frequent type of deterioration because oxygen is a constituent of air and air is always in contact with the oil during the operation of a lubricating system.

Heat has a definite effect on the rate of oxidation. This effect is many times underestimated. It has been said that under average operating conditions, the life of an oil is reduced approximately 50 per cent for every 15 degree rise in temperature above 140°F. Generally speaking, heavy oils have greater resistance to heat than light oils and will oxidize at a slower rate under similar conditions.

Some metals also have an undesirable catalytic effect on oils, particularly at elevated temperatures. Zinc, brass, copper and lead are among the common metals which have the greatest effect. Metals are most active as catalysts when present in a finely divided form. In this latter state, iron is sometimes an active catalyst.

When oxidation of an oil takes place, the chemical reactions which occur result in two objectionable types of products which change the nature of the oil. One type is soluble in the oil and is composed principally of organic acids and varnish-forming materials. The other type is insoluble in the oil and is generally called sludge. Both types are objectionable and either one or the other or both may be formed. The soluble type may cause corrosion or form varnish; the insoluble type may clog lines or oil grooves and thus cause excessive wear on close-fitting moving parts of a mechanism.

The extent to which oxidation takes place in different oils depends on the type of oil, type and extent of refining and whether or not it has been treated with oxidation inhibitors.

There are many types of oxidation tests available for use. These procedures include combinations of the following:

(1) Contacting the oil with air or oxygen.
(2) A prescribed temperature.
(3) A definite time.
(4) Agitation during the test period.
(5) Presence of moisture.
(6) Presence of metal catalysts, varying from one to several.

Results are reported as:

(1) Measurement of the amount of sludge formed.
(2) Increase in neutralization number.
(3) Measurement of increase in viscosity of the oil.
(4) Measurement of the length of time required to produce a specified quantity of sludge or acidity.

There is no universal evaluation test for deterioration by oxidation. The evaluation tests which are available must be recognized as being applicable for specific types of service. There has been a great tendency to borrow a test method designed for some specific service for the testing of a lubricant which is to be used under entirely different conditions. For example, the Indiana Oxidation test which was designed to evaluate the performance of motor oils and is run at a temperature of 341°F should not be used to predict performance of hydraulic oils or turbine oils which normally operate at much lower temperatures.

Since oxidation proceeds more rapidly at elevated temperatures than at low temperatures, there has been a tendency to raise the temperature of the procedure in order to obtain results in a shorter period of time. This is often false economy. At this point, it is only fair to say that the error of such practice has been recognized by some consumers and that tests are being used which require 1,000 hours or longer at temperature of 95°C. The A.S.T.M. "Tentative Method of Test for Oxidation Characteristics of Inhibited Steam Turbine Oils," A.S.T.M. Designation D-943-47T is one of this type.

This word of caution is particularly applicable to the testing of light viscosity mineral oils. An oil having a flash point of 320°F is not intended by the producer to be used on an application which may reach this temperature. Therefore, generally speaking, accelerated oxidation tests should not be run at temperatures above the flash point of the oil.

In conclusion, it must be recognized that correlation between results obtained by laboratory tests and those obtained in actual practice are many times general because of the almost infinite variations found in machine design and plant operating conditions. These oxidation tests are intended to serve as a guide towards

elimination of unsatisfactory lubricants.

9. *Aniline Point.* The aniline point test was originally designed to measure the solvency power of petroleum naphthas. However, as a result of the introduction of synthetic rubber into many systems containing lubricants, its use has also been extended as a means of predicting the behavior of oils on rubber.

Petroleum products, while containing a vast number of organic compounds, are composed principally of three hydrocarbons known as paraffins, naphthenes and aromatics. Aniline is an aromatic chemical and, as such, is more compatible with aromatic hydrocarbons than it is with paraffins or naphthenes. The test is run by heating a mixture of equal parts of aniline and the oil until they are homogeneous, and then cooling until the first complete turbidity appears. The temperature at which this occurs is the aniline point.

Generally oils having a low aniline point, indicating a predominance of aromatic constituents, soften synthetic rubber much more rapidly than oils with a high aniline point, usually causing greater and/or faster rubber swelling.

This test is definitely an indicative one and actual swelling tests should be conducted for correct evaluation. This becomes more necessary as the number and types of synthetic rubber increases.

10. *Sulfur, Chlorine and Phosphorus.* As previously stated, sulfur is present in lubricants as a constituent of the crude petroleum and as an additive or part of one. When it is present as a constituent in the oil, it has little effect on the lubricating qualities except to the extent to which it might become corrosive. However, modern refining procedures usually remove all of the corrosive forms of sulfur from the oil. Sulfur alone, or more often in the form of a chemical compound, can be found in rust preventives, film strength additives, detergents, anti-corrosion compounds and anti-oxidants.

Chlorine is present in lubricants only as an additive and, in practically all instances, the additive is one designed to improve film strength.

Phosphorus is present in lubricants as an additive. It may be found in oils containing rust preventive, film strength, detergent, anti-corrosion or anti-oxidant additives.

From the standpoint of the consumer, tests for these elements are used to determine the amount of additive in an oil. This can be used either as a means for checking shipments or for indicating the amount of additive remaining in a used oil.

Determination for these elements are made by standard A.S.T.M. procedures.

Chemical Tests on Lubricating Greases

The term "grease" as used by the petroleum industry describes mineral oils which have usually been thickened by the addition of various types and combinations of soaps. These soaps are generally fatty oils and/or fatty acids combined with numerous inorganic alkalies. The alkalies usually found in greases are sodium, calcium, aluminum, lithium, barium, lead, strontium and zinc, with the first three by far the most predominant.

1. *A.S.T.M. analysis of Grease.* The A.S.T.M. method for analyzing grease, D-128, involves both qualitative and quantitative analysis of both organic and inorganic compounds. The results of these tests give complete information as to how much of each ingredient is present. But it cannot predict performance because it cannot tell how the grease was compounded. This latter item has just as much to do with performance as do the types and percentages of components used.

The analysis can be used as a guide towards anticipated performance or sections of it can be used as a means of indicating uniformity between shipments.

If the tests show that the grease is one prepared from lime (calcium) soap, it will usually be found to be water-resistant, satisfactory for normal temperature application and unsatisfactory for high tempertures or in fast-moving bearings.

If the tests show that the grease is one prepared from soda (sodium) soap, it will usually be satisfactory at high speeds and high temperatures but may show poor resistance to water.

If the analysis shows an aluminum soap has been used in the lubricant, it may have some of the advantages of both the lime or soda base type since aluminum greases are somewhat water resistant and can be used at moderately high temperatures and moderately high speeds.

Manufacturers of barium, strontium and lithium base greases maintain that these materials approach the universal product everyone wants.

Lead and zinc soaps are usually added to improve film strength and are normally to be used where high pressures exist. Compounds containing sulfur, chlorine or other materials are also added for this purpose. From the standpoint of checking uniformity of shipments, ash content, moisture content and determination of free alkali or free fatty acid where applicable are the chemical tests of most significance. Methods for these determinations are included in the A.S.T.M. Method D-128.

2. *Corrosion Tests.* Nearly all of the statements made with respect to corrosion tests for lubricating oils can be applied to corrosion tests for greases. Adopt that test which takes into account the metals contacted by the lubricant and the maximum anticipated operating temperature to which the lubricant will be subjected.

3. *Oxidation Tests.* The most popular and most overworked oxidation test for grease is the Norma-Hoffman Oxidation Bomb Test. It involves placing samples of grease in a bomb with or without catalysts, introducing a prescribed amount of oxygen, placing the bomb in a bath maintained at elevated temperatures, and observing the drop in pressure due to absorption of oxygen over a period of time. Results are difficult to duplicate between different laboratories and sometimes in the same laboratory.

In addition to the fact that the lubricating oil in the grease will deteriorate in service, soaps and other ingredients in greases may undergo chemical change in storage. These changes usually take place by slow oxidation of the fatty materials present in the soap and are often noticeable by the development of a rancid odor, or change in color, or a hardening or softening of the grease. These changes may make the lubricant unfit for service before it has ever been taken from the drum, or may not permit free or proper movement of bearings or other moving parts which have been filled with grease by the equipment supplier and have been setting on a shelf or in unused esuipment. The Norma-Hoffman test can only predict the rate at which a grease will deteriorate in storage and it is not infallible in this respect. This test should never be used to predict the performance stability of a product. Other tests, mostly physical in nature, have been devised for this purpose.

(*Continued on page* 279)

Effects of Cutting Fluids and Power Requirements in Metal Cutting Operations*

By A. O. SCHMIDT and G. V. B. SIROTKIN
Kearney & Trecker Corporation

IT IS of great importance to the machine tool designer and the production engineer to have methods of checking the effect of cutting fluids in a metal cutting operation. Quite frequently a reduction of the power required in a machine tool is sought and claimed when a particular coolant is applied.

Power at the cutting tool may be measured by employing various methods, each distinctly different from the others. A device commonly used and sufficiently accurate for production setups is the wattmeter which measures electrical power input to the machine tool. Discrepancies caused by varying drive motor efficiency, lubrication and friction factors in gears and bearings often render this method unsatisfactory for precise determination of power required by the cutting tool.

To eliminate these sources of error, dynamometers which measure power at the cutting tool have been designed. Such instruments require expert design and calibration and must be checked frequently. Sources of error relatively impossible to exclude in investigations such as this are variations in workpiece material, which is actually never homogeneous, and changes in cutting edge angles, caused by wear, which begin as soon as cutting starts.

The whole problem of measuring cutting forces becomes somewhat more involved when different cutting fluids are used and an attempt is made to study their effect upon the power consumed at the tool.

In a series of tests carried out in the Metal Processing Laboratories at the University of Michigan,[1]* a number

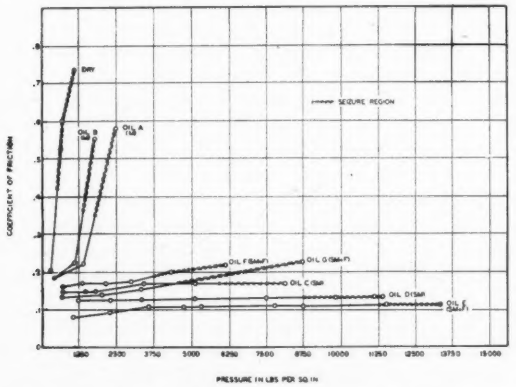


Fig. 1 Friction Tests of Various Cutting Fluids: M, mineral oil; F, fatty oil; SM, sulphurized mineral oil.

of cutting fluids were tested first for their anti-friction properties and then checked for their effect upon the forces on the different elements of a drill when cutting steel.

With an emulsion to which sulphur had been added the coefficient of friction was comparatively small even at higher loads. The greatest reduction in the coefficient of friction occurred when sulfurized oils were used. See Fig. 1. Plain mineral oils and water had little lubricating effect.

In using only the cutting lips of a drill to machine a tubular test bar as illustrated in Fig. 2A, the torque as well as the thrust remained unchanged although the cutting was done in a container filled with cutting fluids which showed great differences in frictional properties. The measurements were taken with an accurately calibrated dynamometer. When holes of the same diameter as the test bar were being drilled in steel (see Fig. 2C), a general reduction in the torque and thrust was observed with cutting fluids as compared to drilling dry.

The lips of the drill when used as shown in Fig. 2A act like single point tools and only the cooling effect of a cutting fluid is utilized under these conditions. However, when a drill operates as illustrated in Fig. 2C, both the cooling and lubricating properties of a cutting fluid will be utilized since there is rubbing friction at the chisel edge point and the land which will be reduced by the application of a cutting fluid. A similar action will take place in an operation such as shown in Fig. 2B where the cutting fluid will reduce the friction on the land. The conclusion arrived at in these tests was:

Cutting fluids, even those which possess high sulphur content, high anti-seizure properties, and low coefficient of friction in the friction tests, will not decrease the cutting forces unless there is rubbing friction on noncutting surfaces of the tool where the antiseizure properties become effective.

Since cutting fluids have no measurable effect on the forces acting on the cutting lips of a drill, a calorimetric balance method for evaluating machinability was developed [2] in which a drill and a tubular test bar were used.

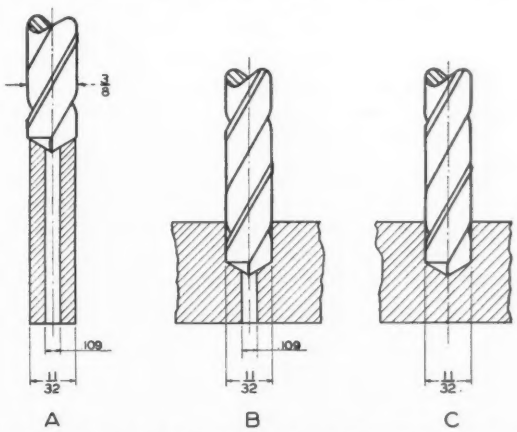


Fig. 2 Test Bars for Drill Tests. The drill in C is the size of the test bar in A but otherwise is identical with the drill in A.
A=Cutting action of cutting edges
C=Cutting action of entire drill
B—A=Cutting action of margin
C—B=Cutting action of chisel edge.

---

* Paper presented at 3rd Annual Convention of A.S.L.E., Buffalo, N. Y., April 20, 1948.

* Numbers in parenthesis refer to the bibliography at the end of the paper.

Dr. A. O. Schmidt is in charge of metal cutting research at the Kearney and Trecker Corporation. Before taking this position, he taught production engineering at Colorado State College, the University of Illinois and Marquette University.

He carried out graduate studies at the University of Michigan and previous to that he was employed for ten years as Mechanical Engineer with the Carl Zeiss Optical Works.

Mr. G. V. B. Sirotkin joined the Kearney and Trecker Corporation in 1937 in the Materials Testing Laboratory.

During the war he served as a Lieutenant in the U. S. Navy in the Pacific area. On his return in 1946 he again joined Kearney and Trecker working on industrial research and special production.

He is a registered professional engineer and obtained his B. S. in Mechanical Engineering Degree from the University of Wisconsin.

Calorimetric Process Applied to Determination of Tool Forces In Drilling

In these tests water is employed as a means of measuring the quantity of heat generated by a combination of friction and deformation during the cutting operation. To measure the quantity of heat thus generated, the tool and workpiece are submerged during the cutting operation in a specified quantity of distilled water. The temperature of the water at the beginning and end of the cutting operation is read with a thermometer. Rate of cooling is observed and used for the determination of the temperature which would have been attained at the end of the cutting operation if no radiation, conduction and convection had taken place. When work is transformed into heat, or heat into work, a quantity of work is the mechanical equivalent of a quantity of heat. Thus by observing the temperature changes of the water surrounding the tool and workpiece during the cutting operation, it is possible to study the power requirement for the cutting of different materials and the effect of changes in tool design upon the power consumption.

The test specimen and the cutting tool are arranged in a container so that both will be covered by water. Therefore, to obtain a correct computation of horsepower, the water equivalent of the container, test specimen, and all the other parts which are immersed in water must be considered with the water in the container. The time of cutting is constant; it can be chosen to suit the particular test and made short enough to eliminate noticeable heating through agitation of the water. To minimize the influence of the surrounding temperature, the water and all parts of the equipment should be at room temperature at the beginning of the experiment. All the necessary values are therefore available for the determination of the horsepower required in the cutting of metals or other materials from the heat generated in the cutting operation.

The calorimeter can be taken as one body of weight W with a temperature t which has a mean specific heat c_m. A change of temperature dt of this body is accompanied by a change dQ of the heat in the body.

$$dQ = Wc_m dt$$

The quantity of heat which this body absorbs when being heated from room temperature t_r to a higher temperature t_h is

$$Q = W \int_{t_r}^{t_h} c_m dt$$

Since c_m can be considered as constant in this case and all parts of the calorimeter as having attained the same temperature

$$Q = Wc_m(t_h - t_r)$$

The calorimetric apparatus is shown in Fig. 4. The main advantage of this testing method is that it shows even small differences in the cutting properties of various metals and alloys. In order to measure the heat generated during the cutting operation as accurately as possible, using only 50 cc of water in these tests is expedient. A larger volume of water causes smaller temperature rises. This makes the differences in thermometer readings less pronounced and also necessitates the use of a correspondingly larger agitator. Readings of torque and thrust were taken simultaneously for each test bar as it was cut in the calorimeter.

The following conclusions were arrived at in this series of tests:

A comparison of the values of horsepower obtained from torque and thrust determinations with those from the heat generated during cutting shows that the calorimetric method gives results comparable to those of an accurately calibrated dynamometer.

The calorimetric setup is more simple than other methods, such as the determination of tool forces with a dynamometer, and its sensitivity permits the accurate determination, quickly and economically, of variations as small as the differences which occur when machining various magnesium alloys.

It was also found that when using various types of cutting fluids, oils, and emulsions in place of distilled water to cover the tool and test specimen, their cooling effect as well as their influence on power consumption can be studied by measuring the difference between the initial temperature and the temperature at the end of the cutting operation.

Calorimetric Analysis Applied to Milling

Although the calorimetric method is well known and widely applied in engineering, little use has been made of the method heretofore, in metal-cutting experiments.

When an investigation of high-speed milling was initiated by the Kearney & Trecker Corporation, a calorimetric method was chosen as the means for obtaining cutter power consumption data [3]). Several thousand tests revealed that a simple calorimeter is reliable and that the power required at the cutting edges of a milling cutter can be evaluated with accuracy employing this method. Only the heat in the chips is used in power determinations and it has been found to be a good indication of the actual power consumption. The chips fall into 150 cc of distilled water which is kept circulating in the calorimeter by an electrically driven agitator. The temperature of the water before and after cutting is recorded and used in the computations for power and chip temperature. The cutting time for each test is very short and errors caused by heat losses are negligible. Each test is started with the calorimeter, water, and equipment at room temperature. Care is taken to avoid any sudden temperature changes in the room during the test.

Cutters with adjustable tungsten-titanium carbide blades are used. Their design is similar except for the radial rake angle which, for various tests, has one of the following values: 30°, 15° or 6° positive, 0°, 6°, 12°, 20° or 30° negative.

A cutter was developed as a result of this investigation; it has solid sintered carbide blades set at 15° positive radial rake and provided with a negative rake face 0.020″ wide at the cutting edge. This milling cutter has been tried extensively in production tests and has proven superior in number of workpieces machined per grind. It has been operated at feeds and depths of cut which would stall a milling machine when ordinary negative rake angle cutters were used. In regrinding the cutter little carbide material has to be removed [4]).

From the calorimetric power tests and cutter life tests which have been conducted for over four years the following points in particular have been established. Negative radial rake angles were found to produce stronger cutting tips, the cutting edges of which are less liable to fail from impact and shock when entering a workpiece of hard material than are the cutting edges formed by positive radial rake angles.

Power required at the cutting edge is higher for the negative radial-rake angle cutter than for cutters with positive radial rake angles. This holds true for conventional cutting speeds as well as for higher cutting speeds up to 1180 fpm when milling steel.

Cutters with negative radial rake angles will stand up longer at the higher speeds when cutting steel than positive radial rake angle cutters under identical conditions. At high speeds wear and failure at the cutting edge of a positive radial-rake angle cutter will soon increase its power consumption above that of a cutter with negative radial-rake angles. Average temperature of the chips produced by ordinary feed does not approach the melting temperature of steel even at high speeds.

A cutter with a 15° positive secondary radial rake angle and a negative primary radial rake face twice the width of feed per tooth, was found to be more effective since it combined the increased strength of the cutting edge afforded by negative radial rake angles with the lower power requirement of the cutter with positive radial rake angles.

Comparative Study of Coolants When Milling at High Cutting Speeds

Tests were made to check on the performance of various cutting fluids at higher cutting speeds in a slab milling operation. The cutting fluids chosen for the experiment were mainly soluble oils and were those well publicized and widely used in various plants.

The tests were carried out on a Kearney & Trecker Model 20 CSM plain horizontal milling machine equipped with a wattmeter calibrated for the efficiency of the 20 hp spindle drive motor to read directly in horsepower output. High-speed-steel cutters 2¾″x3½₂″x1⅛″ with 12 teeth having a 45° helix angle and a 10° positive radial rake angle were used. Analysis of these cutters was as follows: tungsten, 6 per cent; molybdenum, 5 per cent; chromium, 4 per cent, and vanadium, 2 per cent. The workpieces were normalized SAE 4340 forged steel billets 2⁵⁄₁₆″x4″x12⅛″, 220 Bhn.

Care was taken to eliminate as many variables as possible. The 36 milling cutters used in the tests were new and of the same size, analysis, and heat treatment. Similarly, the workpieces were from the same billet and after normalizing were machined to remove scale and decarburization. The wattmeter was connected to indicate the horsepower output of the spindle drive motor only. This avoided any variations due to adjustments of the machine table gibs and thrust bearings.

Preliminary tests were run to determine the extreme to which the cutting speed should be increased to obtain early failure. Cutting speeds of 105, 130, 160, 196 and 246 surface feet per minute were tried successively, cutting dry, until it was found that 308 surface feet per minute produced the desired results. A feed per tooth of 0.003″ and a 0.100″ depth of cut were used in all the tests. The workpiece was held rigidly in a vise.

For purposes of the test, each cutter was run until it failed by excessive peripheral wear. This point of failure was easily ascertained by the effusion of sparks, indicating break down of the cutting edges, and by the sudden increase in horsepower requirements. The number of passes and the horsepower consumption were recorded in each run. In comparing the different cutting fluids, three cutters were used for each coolant and the sum of the number of passes was tabulated. A repetition of these tests with resharpened cutters showed substantially the same results.

TABLE I.

CUTTING FLUIDS TESTED

Coolants Tested	Mix	*Price/ Gal.	Additives
A	40-1	1.66	10 to 15 Per Cent Fatty Oil
B	40-1	3.05	Lubricating Agents and Water Conditioner
C	10-1	.98	High Sulfonic Soap Content
D	40-1	2.13	Mineral Oil and Film Strength Additives
E	40-1	1.66	Mineral Oil and Extreme Pressure Additives
F	40-1	.55	Mineral Oil and Rust Preventative
G	40-1	.87	Colloidal Graphite
H	40-1	7.00	Bentonite
I	40-1	2.95	Special Type Soaps
J	40-1	.88	Colloidal Graphite
Water		.13	0.1 Per Cent Sodium Nitrate

Because of the rigid construction and high horsepower available in the milling machine, the number of passes made before the cutters failed was comparatively large although the cutting speed was much higher than is generally recommended for high-speed steel cutters.

In each instance, the total number of passes made for three cutters was used in comparing the cutting fluids (see Fig. 3). It was noted that the various cutting fluids increased tool life approximately 35 to 150 per cent.

* Price based on five gallon lots.

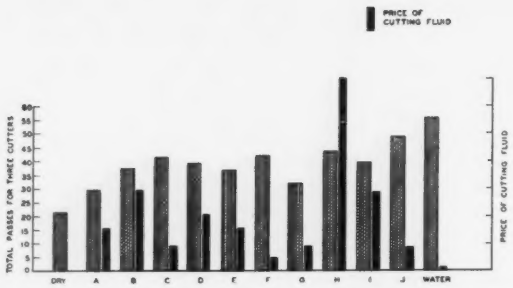


Fig. 3 Graphical Representation of Tool Life in Milling Tests with various Coolants together with Comparative Prices.

Horsepower readings for individual cutters varied within plus or minus 10 per cent of the average values. When using oil instead of an emulsion in these tests, the power readings were the same, but too much smoke occurred because of the very hot chips at these higher cutting speeds.

The coolants listed in Table 1 were also tested in the calorimeter (see Fig. 4), using a tubular test bar of SAE 4140 steel, 0.375″ in diameter, with a pilot hole of 0.110″ diameter. A 7/16″ drill with a helix angle of 30°, a point angle of 118° and 12° relief angle was used as the cutting tool. The tests were run on an autometric boring machine, the spindle rotated at 1000 rpm and the feed was 0.0057″ per revolution. The temperature difference between the beginning of the cut and after the drill had machined 0.250″ from the length of the test bar was practically the same for all of the coolants including water (see Fig. 5). The same test with a number of oils gave a calorimeter temperature rise about 90 per cent greater than those plotted in Fig. 5.

In order to check the results obtained by the calorimetric method for determining the specific heats of the cutting fluids, simple laboratory tests employing the method of mixtures were run. Making use of the basic fact that when two liquids at different temperatures are mixed together, heat is transferred from the hotter one to the cooler one until thermal equilibrium is reached, this thermal equation was set up:

$$c_a m_a (t_a - t_e) = c_b m_b (t_e - t_b)$$

heat lost = heat gained

Where c = specific heat
m = mass in grams
t_e = temperature at equilibrium in degrees Centigrade

Taking 100 cc samples of water as liquid b at room temperature and its specific heat as 1, weighed samples of 25 cc of the various cutting fluids were heated to approximately 60° C and then mixed with water at room temperature and the equilibrium temperature measured. By applying the above formula it was found that the specific heats of all the cutting fluids tested were substantially the same, namely, approximately that of water.

Since, as previously mentioned, cutting fluids do not reduce the tool forces in a machining operation of this kind, calorimetric temperature changes should be constant in all cases unless there is a difference in the specific heat of the calorimeter fluid. Therefore, these tests indicate that the specific heats of the various coolants tested are about equal to that of water and therefore all will have about the same cooling qualities.

During these tests no reduction of power consumption due to any of the cutting fluids tested was noted. All coolants provided increases in tool life as compared with dry cutting. Water containing a rust inhibitor showed the greatest increase in tool life.

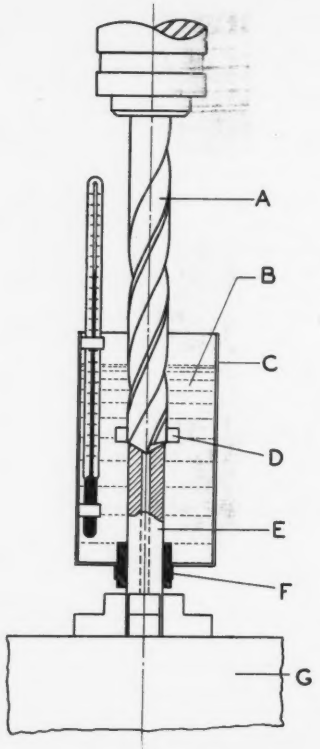


Fig. 4 Calorimetric Apparatus for Drilling Tests with Coolants Used in Milling. A, drill 7/16″ diameter; B, 50 cc of water; C, container; D, blades on drill for agitation; E, 3/8″ diameter test bar; F, rubber grommet; C, three jaw chuck.

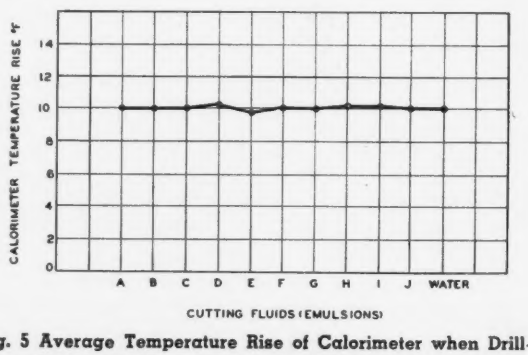


Fig. 5 Average Temperature Rise of Calorimeter when Drilling with the Coolants used in the Milling Tests.

These tests indicate that:

1. The use of cutting fluids will improve the cutter life even at high cutting speeds;
2. No noticeable reduction of power will occur with the application of cutting fluids if rubbing friction on non-cutting surfaces is absent;
3. Water is the most effective portion of any coolant when milling at high surface speeds; and
4. The cooling qualities of a cutting fluid can be determined quickly through a short test in a drill calorimeter.

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 5161 (Sec. 510, P.L.&R.) Cincinnati, O.

LUBRICATION ENGINEERING

American Soc. of Lubrication Engineers, Publisher

22 East 12th Street

CINCINNATI 10, OHIO

_____, _____
(Date & Month) (Year)

Gentlemen:

☐ Please enter my subscription for LUBRICATION ENGINEERING for _____years, effective with the_____issue, published bi-monthly.

☐ Please send me information regarding membership.*

Regular Subscription $4.00 per year ☐
$7.00 for Two Years ☐
Payment Mailed ☐ Send Bill ☐

Name_____ Title_____

Company _____

Street Address_____

City_____ Zone_____ State_____

With which branch of the Lubricating Industry is your company identified:

Manufacturing ☐ Consulting ☐ Educational ☐
Lubricant Producer ☐ Servicing ☐ Other ☐

*Note: Membership Includes Subscription to LUBRICATION ENGINEERING.

Bibliography

1) "Correlation of Coefficient of Friction with Drilling Torque and Thrust for Different Cutting Fluids." A. O. Schmidt, W. W. Gilbert, O. W. Boston.
Trans. A.S.M.E., Vol. 64, No. 7, October 1942, pp. 703-709.

2) "A Thermal-Balance Method and Mechanical Investigation for Evaluating Machinability." A. O. Schmidt, W. W. Gilbert, O. W. Boston.
Trans. A.S.M.E., Vol. 67, No. 4, May 1945, pp. 225-232.

3) "An Investigation of Radial Rake Angles in Face Milling." J. B. Armitage, A. O. Schmidt.
Trans. A.S.M.E., Vol. 66, No. 8, November 1944, pp. 633-643.

4) "How to Select Carbide Milling Cutters." D. V. Stevens, A. O. Schmidt.
American Machinist, Vol. 90, No. 22, October 24, 1946, pp. 112-116.

Discussion of Paper by A. O. Schmidt and G. V. B. Sirotkin on "EFFECTS OF CUTTING FLUIDS AND POWER REQUIREMENTS IN METAL CUTTING OPERATIONS"

WALTER A. ALEXANDROFF
Technical Advisor Pate Oil Company, Milwaukee, Wisconsin

We feel that the authors of this paper are to be complimented on their work in endeavoring to evaluate the effect of cutting oil emulsions on milling cutter tool life. As there is very little conclusive data available on the performance of cutting oil emulsions any effort in this direction is highly desirable.

The interesting fact brought out in the milling cutter test results is that the milling cutter evidently functions much like a single point cutting tool and under these conditions the cooling quality of the cutting fluid is most important. Certainly this was the case in the drilling tests conducted by the author, wherein the lips of the drill acted as a single pointed tool (Fig. 3A) and only the cooling effect of the cutting fluid was utilized. Although it is known that these cutting oil emulsions contained various lubricity and extreme pressure addition agents, they were not so evaluated in this test. Experience indicates that in other types of metal cutting operations such as broaching, drilling, tapping, etc., wherein there is rubbing friction on non-cutting surfaces, the lubricating qualities of the cutting fluids would become more important and the differences in the addition agents would be more pronounced. At very low cutting speeds even in turning operations, it is possible for a cutting fluid to act as a lubricant.

We are sure some very interesting results would have been obtained if this same series of cutting fluids had been tested under the test conditions employed by the author in his earlier work at the University of Michigan in measuring the coefficient of friction and while drilling steel.

In connection with the study by Dr. Schmidt and Mr. Sirotkin on these cutting oil emulsions, we thought it might be of interest to determine the Ph value of the emulsions on the Coleman pH Meter using glass electrodes and also to test them on the Falex machine using a method suggested by Samuel Spring of the Frankford Arsenal (Steel, Dec. 24, 1945). The results of these tests are listed below. The emulsions were also subjected to a corrosion test (Federal Test No. 530.6) on 1010 cold roll steel, aluminum and copper. In all cases except emulsions C & D on copper, the corrosion results were negative.

Cutting Fluid	pH Value	Falex Test Final Torque Reading @ 2750 lbs. Jawload
Dry	——	Failed
A	8.7	76
B	8.7	67
C	9.1	78
D	8.7	56
E	8.5	52
F	9.6	69
G	8.6	Failed
H	8.6	74
I	10.1	56
Water	7.5	Failed
.1% Na NO_2		

Discussion of Paper by A. O. Schmidt and G. V. B. Sirotkin on "EFFECTS OF CUTTING FLUIDS AND POWER REQUIREMENTS IN METAL CUTTING OPERATIONS"

PROFESSOR O. W. BOSTON
University of Michigan

The paper by Dr. A. O. Schmidt and Mr. G. V. B. Sirotkin confirms and establishes many principles. By means of the drilling calorimeter developed at the University of Michigan by Schmidt, it is possible to establish a heat balance with the work determined by a torque and thrust dynamometer. The influence of the chisel edge and the margin of a drill is readily distinguished quantitatively from the actual metal cutting end.

The calorimeter developed for milling likewise yields valuable data regarding the performance of cutting fluids at high speeds.

The results presented in this paper are in line with what I expect and should be of great value to industry.

NEW SCHOOL FOR LUBRICATION IN ITALY

Digest written by Paul H. Black, Cornell University from a paper in English entitled "The Italian Scuola della Lubrificazione" by Dr. Ing. A. G. Recine, Chief Executive of the school in Genoa.

IT WILL be interesting to engineers to know that the need for knowledge about lubrication has been felt so strongly in a European country that a school for lubrication has been established. It is called the "Scuola della Lubrificazione" and was established in 1943 in Italy by Dr. Recine, who is its chief executive. The need for such a school and its functioning are so interestingly and pointedly described by Dr. Recine that this article was prepared from his statements.

In Italy there were many "old" machines before the last war. In the design of these machines, a fundamental mistake was made in forgetting that lubrication should "harmonize" two elements, i.e., the surfaces in contact and the lubricant. Even though these machines are now considered "worn out," they can be made serviceable again by replacing worn parts, and by providing proper adjustments and lubrication to others. This is essential in Italy, where machines are needed but cannot be bought or made in required numbers.

(*Continued on page* 275)

CURRENT LITERATURE

The Institute Spokesman, Vol. XII, July, 1948

SUPPLY AND DEMAND FOR LUBRICANTS UNITED STATES YEARS 1918-1947 FORECAST THROUGH 1951
McIntosh, A. J.—pp. 4-6, 8-9, 20, 21, 24

Tabulated data are shown and graphs give correlation between consumption of industrial lubricants in the U. S. and the Federal Reserve Board production index and total demand for lubricants, (U.S.,) showing exports and domestic uses.

Journal of Chemical Physics, Vol. XVI, No. 7, July, 1948

GENERAL THEORY OF THE FORMATION OF LIQUID FILMS
Robinson, L. B.—pp. 734-736

Langmuir's theory of the formation of liquid films in narrow capillaries is developed for the general case of any electrolyte. The determination of the thickness of such films involves hyperelliptic integrals. By suitable transformations one can represent the intergrand as the product of binomial series and Legendre's series. No attempt is made to evaluate the thicknesses of the film numerically, because of the complexity of the necessary computations.

Mechanical Engineering, Vol. 70, No. 2, February, 1948

STUDIES IN BOUNDARY LUBRICATION—II—p. 158
Influence of Adsorbed Moisture Films on Coefficient of Static Friction Between Lubricated Surfaces. ASME 47-A-18.
By: W. E. Campbell and E. A. Thurber

Modern Industry, Vol. XV, No. 5, May 15, 1948

SOAPLESS SOAPS, WHAT THEY CAN AND CAN'T DO
Anon.—pp. 40-44

The textile industry has known about these materials for a long time; but only recently have other industries begun to take advantage of their unusual properties. Added to lubricants—for instance the oil emulsions used in metal rolling—these compounds reduce friction so much that it's possible to increase operating speed. These materials got their start as soap substitutes in Germany during World War I. Today, the alkyl aryl sulfonates account for the largest tonnage of synthetic surface-active agents on the market. Anionic wetting agents (materials not used for cleaning) include: "Aerosol," "Alkonol," "Areskap," "Monosulph," "Nekal," and "Tergitol." Cationic compounds, those which produce positively charged particles in solution, include: "Ammonyxide," "Catiosan," "Emulsept," "Nopcogen," "Roccal," "Triton X-400," "Tetrosan," and "Zylium." Nonionic compounds, those which are neutral in solution, include: "Alrosol," "Cerfak 1300," "Emcol 5100," "Igepal," "Neutronyx," "Nopalcol," "Sterox," and "Triton X-100."

Oil & Gas Journal, Vol. XLVII, No. 10, July 8, 1948

CONSTRUCTION MAKING BATON ROUGE WORLD'S MOST COMPLETE REFINERY
Duff, D. M.—pp. 48-49

One of the largest refinery expansion programs in the United States is under way at Baton Rouge, Louisiana, refinery of Esso Standard Oil Company. This plant is already one of the world's largest refineries. A new crude distillation unit of 58,000 barrels per stream-day capacity, two new vacuum distillation units, and various new lubricating oil facilities are being worked on. New construction will add considerably to total plant capacity, which this year was: crude charge capacity 180,000 barrels daily with runs of 200,000 barrels daily. Expansion of two catalytic cracking units and auxiliary facilities is planned, as well as light-ends recovery and polymer plant-new compression, absorption, and distillation equipment, new rerun unit-distillation unit to recover motor-gasoline base stocks from low-octane distillate, new dewaxing plant (M.E.K.), expansion of waxy-distillate pressing capacity, asphalt drum filling—modernization, antifreeze blending, butadiene extraction, etc.

MOTOR OILS—1948
Geniesse, J. C., and McGrogan, J. F.—pp. 67, 68, 71-73

The general requirements of motor oils are considered. To operate satisfactorily in the internal combustion engine the oil must lubricate the surfaces, seal the compression rings, cool the piston, reduce friction and withstand high loads. The authors discuss pour points, iron oxidation and engine rusting, the use of detergents and their effectiveness.

Vol. XLVII, No. 14, Aug. 5, 1948

STANOLIND PLANS BIG LABORATORY FOR PRODUCTION, SYNTHESIS WORK
Anon.—p. 41

One of the world's largest petroleum laboratories will be erected in Tulsa next year by Stanolind Oil & Gas Co., and will be devoted entirely to research on problems of exploration, production, and natural-gas processing.

TIDE WATER WILL BUILD HOUDRY UNIT AT DRUMRIGHT.
Anon.—p. 41

Tide Water Associated Oil Co. has contracted for installation of a Houdry Thermofor catalytic cracking (T.C.C.) unit at its refinery at Drumright, Oklahoma.

RECLASSIFICATION OF CRANKCASE OILS TO REDUCE REFINING COSTS, AND SIMPLIFY DISTRIBUTION AND SUPPLY
Foster, A. L.—pp. 70, 73

Efforts have been under way for a considerable period by some refining and automotive technologists to revise the partially obsolete crank-case lubricating-oil classification. Several proposals for revision of the existing system have been advanced.

STRATIFICATION IN STORAGE
Nelson, W. L.—p. 94

Technical men agree that stratification of totally liquid materials does not occur upon standing. Thus, the only way that stratification can exist in tanks which contain nothing but liquid oil mixtures is by the pumping of one layer of material on top of another. Even such a stratification tends to mix itself over long services. Obviously, if a solid, such as wax, is present or is produced by cooling, it can, to some extent, settle. Apparently the continual rise and fall in temperature of the tank results in fractional crystallization followed by settling of the wax. Results, however, are quite erratic. Table 1 indicates the results.

PRESSURE DROPS—60 F. (GRAPHICAL PRESENTATION)
Nelson, W. L.—p. 103

A graph shows pressure drop per 100 ft. equivalent length-pounds per square inch, plotted against gallons per minute at 60 F (gasoline, kerosene, gas oil and lube oils).

SINCLAIR MEETS TRANSPORTATION PROBLEMS IN EXPLORING ITS ETHIOPIAN CONCESSION
Taylor, H.—43-45

The geography, geology, and working conidtions in Ethiopia, where Sinclair Petroleum Co. is now exploring its concession, are here described by a geologist who has just returned. Auto transport is difficult. Air transport is used.

SINCLAIR DEVELOPS NEW RUST PREVENTIVE, RD—119
Anon.—p. 115

There is no predictable limit to the length of pipe line that can be rust-prevented by injection of RD-119. The additive does not affect the specification tests or performance of the products to which it is added, nor will it result in any higher cost.

Petroleum Vol. XI, No. 7, July, 1948

ADDITIVE MOTOR OILS
Anon.—pp.159-160

Referring to the paper recently presented to the American Society of Automotive Engineers by C. M. Larson, Chief Consulting Engineer to the Sinclair Refining Company, the author takes up the role of additives to motor oils and Diesel fuels. He discusses the effect of air/fuel ratios, the blow-by gases and their effect on sludge, need of ventilation, and additive type upper cylinder oil.

LUBRICATING COMPOUNDS
Anon.—p. 166

A new series of lubricating compounds, ranging from liquids to solids and from water-soluble or water-dispersible materials to oil-soluble materials, has been developed for drawing, sheeting and stamping non-ferrous materials. Increased operating speeds and prolonged life of the dies with which they are employed result from the use of these products, which do not break down during operation or produce scum.

Petroleum Marketer, Vol. XVI, No. 7, July, 1948

EQUIPMENT MAINTENANCE, LUBRICATING EQUIPMENT
Anon.—pp. 10-11

The measures to be kept in mind in order to prevent lubricating equipment from being exposed to damage caused by dirt are indicated.

Petroleum Times, Vol. LII, No. 1330, July 30, 1948

PROGRESS IN THE SCIENCE AND ART OF LUBRICATION
Paterson, E. V. —pp. 763-765

The author discusses the deposits formed from fuels, effect of sulphur in fuel, reduction of engine deposits, corrosion tests, oiliness, drawing compounds, hydraulic fluids, silicones, additives, bearing design and the development of the research.

Revue de L'institut Francais du Petrole et Annales des Combustibles Liquides, Vol. III, No. 2, February, 1948

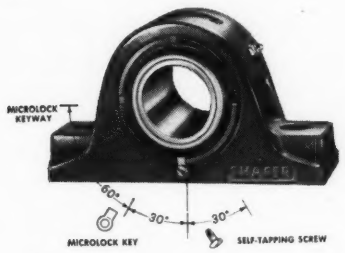
(*Continued on page* 281)

NEW PRODUCTS and EQUIPMENT

NEW MICROLOCK ADJUSTMENT

Shafer's improved units offer three exclusive features that appeal instantly to the man experienced in bearing application and maintenance. The first is the new design housings—stronger, easier to use.

The second of the three Shafer exclusive features is the famous Shafer "Z" Seal, which is outstanding in sealing efficiency and self-aligning—and provides for radial float.



The third is the revolutionary new Shafer MICROLOCK Adjustment. Without fuss or bother MICROLOCK permits actual micrometer steps of bearing adjustment (.005" on smaller units, .007" on larger units) with no tools but a screwdriver. No drilling for set screws with the possibility of chips entering the bearing. No damaged threads to interfere with removal of the cover or later modification of the bearing adjustment, should such be desired.

The Shafer "Z" Seals and MICROLOCK with 12-Point Adjustment are standard features at no extra cost in all Shafer Self-Aligning Roller Bearing Units. The exclusive Shafer "Z" Seal keeps the dirt out and the grease in. The Shafer 12-Point MICROLOCK Adjustment provides micrometer steps of bearing adjustment. For further information write: Shafer Bearing Corp., P. O. Box 57, Downers Grove, Ill.

NEW PRODUCT INDEX

E. F. Houghton & Co., of Philadelphia, has issued a new attractive product index designed to guide purchasers in the various applications of Houghton products. The folder lists the products by trade name and their individual applications. They include such categories as lubricants, metal working, textile processing, leather oils and greases and hydraulic and transmission products.

NEW ROTATING SHAFT SEAL

Advanced design and ease of installation are features attributed to the new rotating shaft seal, Gits "Roto-Flex," developed and marketed by the Gits Brothers Manufacturing Company, Chicago, 40-year-old firm specializing in oil cups and other lubricating devices. The seal is said to be suitable for such applications as water and oil pumps, fuel oil and gasoline pumps, water circulators, refrigeration compressors, speed reducers, and numerous other industrial uses.

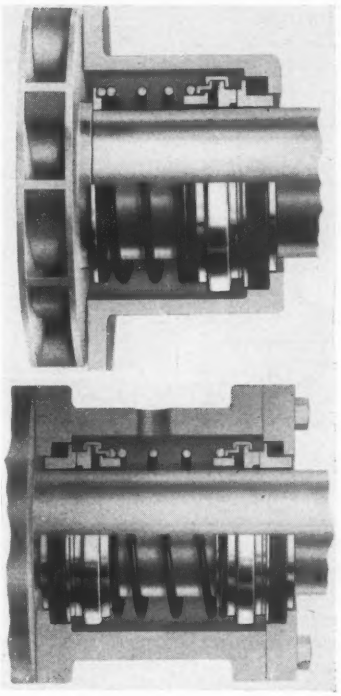
In a colorful eight-page bulletin, the company graphically illustrates the construction details and the many advantages ascribed to the new seal. Essentially, Gits "Roto-Flex" has just three main components, a fact that points up its extreme simplicity of construction, ease of incorporation into user's design, and saving in installation time. The rotating member, called the "seal nose," is an integral unit and cannot come apart. It is held by a compression spring against the fixed surface, or "stationary seal."

In addition to the single Gits "Roto-Flex," double units (two rotating seals mounted on opposite ends of the compression spring) are also furnished; these are designed for such installations as one where the liquid being sealed cannot act as a lubricant or coolant, and a separate liquid supply is admitted into the seal chamber.

Copies of the bulletin, further information and prices may be obtained from Mr. Frank A. Kovarik, General Sales Manager, Gits Bros. Mfg. Co., 1846 Kilbourn Avenue, Chicago 23, Illinois.

BULLETIN No. 506-A

An interesting and informative bulletin has just been issued by the New York and New Jersey Lubricant Company on the proper usage of Non-Fluid Oil, giving complete instructions to the maintenance department in the use of the lubricant from the original container to the bearing. It is good reading. Copies of this booklet may be obtained, free of charge, by writing to New York and New Jersey Lubricant Company, 292 Madison Avenue, New York 17, New York, originators and sole manufacturers of "Non-Fluid Oil."



CLASS AT ROCHESTER TECH.

An outstanding event in educational activities for lubrication engineers took place November 10 to 19, when a maximum group of 20 men attended "A Machine Tool Familiarization Program for Sales and Service Personnel," presented at the Rochester Institute of Technology, Rochester, New York.

This was the second such course to be offered and was designed to acquaint the industrial sales engineer with the machine tools, test equipment and materials used by the manufacturers buying his products.

With extensive laboratory facilities available the "student" was able to acquire the vocabulary, the shop knowledge and general understanding of machine tools which will increase his effectiveness in handling customer problems.

The teaching personnel for the course was composed of Institute faculty members plus representatives of the machine tool builders.

Companies participating in the program were The Atlantic Refining Co., Esso Standard Oil Co., Shell Oil Co., Socony-Vacuum Oil Co., Sun Oil Co., Allegheny Ludlum Steel Corp., Reynolds Metals Co., and Wyckoff Steel Co.

MOTOR-MATIC GREASE WORKER

A labor-saving grease working machine used in determining the consistency of lubricating greases has been developed by the Precision Scientific Co. of Chicago 47, Illinois. The grease worker conforms to the latest A.S.T.M. D217 specifications, and the Army-Navy AN-G-15a tests of aeronautical greases.

According to A.S.T.M. Method D217, the grease must be worked with sixty strokes per minute before the penetration tests. For the Army-Navy test AN-G-15-a, the Motor-Matic is considered a necessity, as the grease must be worked with 100,000 strokes. The grease to be tested is placed in the grease worker which is fitted with a changeable plunger plate having the 51¼" holes as prescribed in the A.S.T.M. method, or the 270 1/16" holes as prescribed in the Army-Navy tests. The plunger is operated by ¼ H.P. motor with a built-in gear reduction that drives the crank at the approximate speed of sixty strokes per minute, as required in the A.S.T.M. specifications. A counter automatically turns the machine off at the end of the sixty or the 100,000 work strokes.

The Motor-Matic grease working machine comes in a single or dual unit. For the laboratory making relatively few tests, "Precision" has an extremely easy to manage hand-operated grease worker. This unit is equipped with a long handle for leverage and requires a minimum amount of energy in its performance.

CASE HISTORIES

Readers concerned with the use of cutting oils and coolants will be interested in a series of Case Histories compiled by The F. E. Anderson Oil Co., Portland, Connecticut.

Broaching, Drilling-Tapping and Grinding operations were performed by a number of metal working manufacturers on a variety of materials, including several types of cast and forged steel, iron and copper. Various cutting oils and coolants were used and results compared on a basis of production and savings.

Information has been grouped into the three classifications mentioned above, with engineering data given on four Case Histories Under each heading.

These Case Histories will be sent free of charge, upon request to The F. E. Anderson Oil Co., Portland, Connecticut.

GRAVITY SEPARATOR

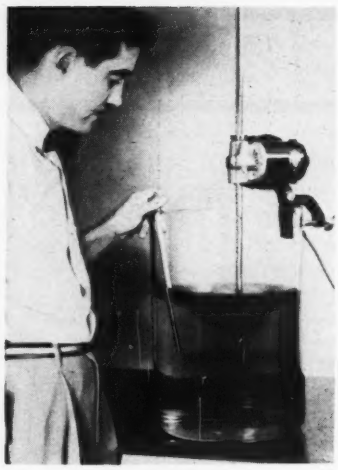
The W. R. Carnes Company, originators of the now universally used sump tank cleaning machines, again announces a first in revolutionary plant equipment.

In the "Carnes" Constant-Flow Gravity Separator a time-tested engineering principle has been designed into a new self-operating unit to save material costs and increase production efficiency.

The "Carnes" Constant-Flow Gravity Separator has its principle application as an attachment in Industrial Alkali Washing Machines. It is designed to save washing compound, to maintain the washing solution at a uniform concentration, to remove and separate the oil film and scum that collects on the surface of the washing solution, and to prevent this oil film and scum from clogging drains and sewer pipes. When using this equipment all of the overflow is caught in the Constant-Flow Gravity Separator, where the oil is separated out and the clean washing solution is returned to the washing machine for re-use.

Being fully automatic in operation the "Carnes" Constant-Flow Gravity Separator requires no attention and will give years of efficient, money saving service.

This equipment, along with all other "Carnes" products, is marketed by the Coolant Clarifier Company, 5837 South Ashland Ave., Chicago 36, Illinois, who are the exclusive marketing and distribution organization for Carnes Equipment and have National representation.



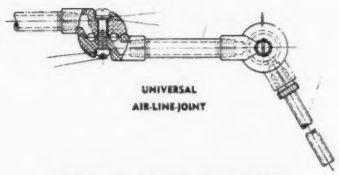
MODEL No. 8 STIRRER

Eastern Industries of New Haven, Connecticut, announces the production of a new, heavy duty stirrer. Designed for use with thick, viscous preparations, the Eastern Model No. 8 is said to be compact, portable, efficient, and economical to use in many applications. It is claimed to stir from 1 to 10 gallons of heavy fluid; will handle much larger quantities of thin mixtures.

It is powered by a General Electric universal open frame motor rated at 1/15 horsepower for continuous duty A.C. or D.C., 110 volts only. The speed control—a permanently-installed rheostat type—permits variable speeds of 80 to 840 RPM. Reduction gears in the mechanism consist of a hardened worm and bronze gearing. The hardened gear shaft turns in special bronze composition bearings. Permanent oil seals are said to prevent any oil seepage.

Eastern states that the ½" propeller shaft can be adjusted to length within a 30" range by means of a hollow gear shaft and a collet chuck at the top of the gear case. Attached to this shaft is a two-blade, stamped stainless steel propeller 5½" in diameter, held in place by a stainless steel cap nut.

The stirrer is available with a screw clamp or ringstand handle mounting. It is supplied with a rubber covered cord, complete with a feed-through switch. For complete details on this and other electrical stirrers, write Eastern Industries, Inc., 296 Elm Street, New Haven 6, Connecticut.



NEW AIR-LINE-JOINT

This new Universal Air-Line-Joint fills a need in many plants for directing and maintaining a jet of liquid or air to any point or object in a machine operation. Its use eliminates the frequent adjustment necessary when using make-shift pipe fitting assemblies.

Originally designed for use on die sinking machines, for expelling chips from the die cavity, keeping layout lines on the dies visible to the operator at all times.

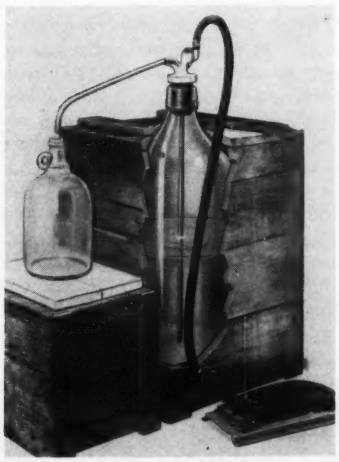
Now used in many ways: With liquid coolant on Saws, Screw machines, lathes, and milling machines and for use with compressed air on Die Filers, Milling Machines and Saws.

Machine vibration will not move it—Swivels full 360°. It is light in weight, only 3½ oz. Streamlined aluminum parts offer minimum obstruction to operator's view.

Additional information and prices can be obtained from the manufacturer. Write Universal Air-Line-Joint Mfg. Co., Lafayette, Indiana.

IMPROVED G-S ACID PUMP

Safe and convenient transfer of acids and other liquids from carboys, barrels or drums is now possible with the improved foot-or hand-actuated Pneumatic Pump. Liquids flow smoothly and stop instantly. They come in contact only with the corrosion-resistant tube and cannot affect other parts. No tilting of the container is necessary. When removed, from container, liquid drains completely.



G-S Pumps with lead tubes are suitable for Sulphuric, Hydrochloric, Hydroflouric Acids and many others. Saran Plastic Tubes are recommended where Pump is to be used in Nitric, Muriatic, Citric, Phosphoric, Acetic, Bleaches, and others.

These safe pumps are essential wherever acids are handled in small measure . . . in industry, laboratory, plating-room or battery service station. Order direct or send for descriptive literature. General Scientific Equipment Co., 2700 W. Huntington Streets, Phila. 32, Pa.

CENTRIFUGAL CLARIFIER

The W. R. Carnes Company of Madison, Wisconsin, through their marketing organization, the Coolant Clarifier Company, 5837 South Ashland Avenue, Chicago 36, Illinois, announces the "Carnes" Model LB Centrifugal Clarifier. This unit, designed for the filtration of coolants, is for permanent installation on machine tools.

The coolant enters the clarifier before flowing into the sump and by gravity and centrifugal force passes the coolant through a fine filter bag at an average rate of 30 g.p.m. The filtering efficiency is claimed to be better than 90 per cent. This results in practically a complete elimination of the necessity of cleaning the sump.

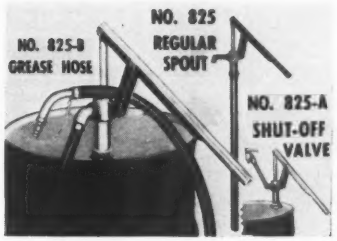
The filter bag will retain 30 to 50 pounds of solids without retarding the flow of the coolant.

The "Carnes" Model LB Centrifugal Clarifier replaces the Model GA Clarifier. The principal changes are stepped up flow rate, increased filtering efficiency and smaller dimensions.

NEW DRUM PUMP

Special spider design of the piston and intake opening provides a cut-through action and large capacity that handles any fluid, which seeks its own level, except lacquer thinners. Heavy greases are pumped at rates up to 3 gallons per minute and even higher for alcohol and other light fluids. Smooth flow is maintained for all fluids.

Installation is easy and rapid, pump simply screws into drum bung. The bung bushing fits both 2" and 1½" barrel opening on 15, 30 and 60 gallon drums.



The pump is available in three economically price models: (No. 825); equipped with shut-off valve to eliminate losses by evaporation (No. 825 A); equipped with 8-foot grease hose (No. 825 B).

Order direct from General Scientific Equipment Company, 2700 W. Huntington Street, Philadelphia 32, Pa., or write for descriptive literature.

ALMEN EP LUBRICANT TESTER

Several inquiries have been received by the American Society of Lubrication Engineers regarding the availability of the Almen E.P. Lubricant Testing Machine, which was developed by the General Motors Corporation Research Laboratories, Detroit, Michigan.

To date this machine is not commercially available and arrangements are being made with the Precision Scientific Company for manufacture, providing a sufficient number of companies are interested.

Anyone wishing to secure this machine, please write the American Society of Lubrication Engineers, 343 South Dearborn Street, Chicago 4, Illinois, Attention: W. F. Leonard. Phone: Webster 9-3848.

NEWS FROM SCOTLAND

We received an interesting communication from Mr. Peter W. Murray, Lubrication Engineer of Lanarkshire, Motherwell, Scotland. Mr. Murray is a member of A.S.L.E. and says in his letter "It may be of interest to you to know that the necessity for lubrication engineers is becoming fully appreciated by most of the large producers in this country and it has been the A.S.L.E. which has been the foundation and driving force for recognition of the profession of Steel Works lubrication engineers." We were very glad to hear from Mr. Murray; it is such comments that aid and inspire in the carrying out of the fundamental policies of the A.S.L.E.

NEWS OF THE SECTIONS

BOSTON

The first technical session of the newly formed Boston Section was held at the M. I. T. Graduate House on Monday, October 18th. The speaker of the evening was Charles L. Pope of the Eastman Kodak Co., who gave an address on the general subject of Lubrication. The meeting was well attended and Officers were elected: Chairman, A. E. Baker, Jr., Thomson Laboratory, General Electric Co., River Works, 920 Western Avenue, West Lynn, Mass.; Vice Chairman, D. F. Wilcox; Secretary-Treasurer, R. B. Lewis, Shell Oil Co., Inc., 441 Stuart Street, Boston 16, Mass. Plans were immediately made for the next meeting, which was held on November 22nd. The speaker was Frank Ross of E. F. Houghton & Co., Cleveland, who spoke on the subject of "Extreme Pressure Lubricants and Lubrication Under Heat Conditions." Both meetings were well attended.

BUFFALO

On the evening of October 19th, the Buffalo Section met in Hamilton, Ontario, Canada, where Mr. Frank W. Vogt, Sales Manager of Ryertex Division, Joseph T. Ryerson Co., spoke on "Plastic Bearings and Water Lubrication." There was a spirited discussion following Mr. Vogt's presentation and many new ideas were gained. The November 18th meeting was held at the Eastman Kodak Company, Kodak Park Service Dining Room, and was followed by a plant visitation. The meeting was under the direction of Co-Chairman Charles L. Pope.

CHICAGO

The opening session of the Chicago Section was held at the Builders' Club the evening of October 21st. The dinner was preceded by a sponsored cocktail period, which is an innovation of this Section and will be a regular feature.

Dr. J. I. Clower of Delaware University was the speaker of the evening and talked entertainingly on "Modern Aspects of Lubrication" and dwelt on the influence of viscosity and various other factors in the theoretical field of lubricants. The second technical session was held on November 18th, at the same location, when Mr. H. V. Miles, Jr., of the Honan-Crane Corp., discussed "The Role of Adsorbents in Industrial Oil Purification." Mr. Miles handles this subject well. Future meetings of this Section will be on the third Thursday of each month.

CLEVELAND-YOUNGSTOWN

On the evening of October 26th, this Section conducted a quiz program at which the members asked the "Board of Experts" questions pertaining to Lubrication. Included in the "Experts" were:

O. L. Maag
C. E. Pritchard
A. O. Willey
J. L. Finkelmann
R. I. Potter
C. A. Bierlein

Mr. George L. Sumner, our National President, acted as Master of Ceremonies. All in attendance voted that this was the most interesting meeting that Cleveland-Youngstown has held.

CONNECTICUT

The first technical session was held Wednesday evening, November 3rd, at the Hotel Taft in New Haven. Mr. F. O. Hoaglund, Master Mechanic, Pratt & Whitney Division, Niles-Bement-Pond Co., spoke on "Lubrication of Machine Tools." Mr. Hoaglund speaks from long and varied experience and illustrated his talk with many slides showing important recent developments in Lubrication. A Coffee Talk, following the dinner, was sponsored by the Ethyl Corp. on the potential hazards involved in the handling and storage of explosive fluids. This Section has already doubled its membership since the organization meeting and they predict it will again be doubled before the next technical session.

DAYTON

Mr. Anthony J. Zino, Jr., Assistant Sales Manager of Swan-Finch Oil Corp. of New York, addressed the Dayton Section on the evening of October 26th at the Engineers' Club on "Industrial Hydraulic Fluids." Mr. Zino has specialized in this field for a number of years and is well qualified to discuss this critical use of petroleum.

DETROIT

The third technical session of this season was held at the Rackham Memorial Institute, Monday evening, November 22nd. Mr. Melville Ehrlich, Chief Chemist of American Lubricants, Inc., spoke on "The Influence of Chemistry in the General Field of Lubrication." As usual, Mr. Ehrlich's paper was well received and presented with his usual enthusiasm. Past President, Mr. O. L. Maag, and the National Secretary, Mr. W. F. Leonard, attended the meeting and saw the local membership campaign get away to an excellent start.

The Christmas party will be held on December 17th at the Fort Shelby Hotel. The members are urged to help make this as successful as the last Christmas party which was remembered for its magnificent attendance and the fine entertainment and Holiday spirit that prevailed.

FORT WAYNE

A business meeting of this Section was held on October 14th at the Van Orman Hotel. An Executive Committee was elected, consisting of:

Charles J. Egger — F. Buckner
George A. West — J. R. Jarrell

It was voted to hold their regular meetings on the second Thursday of each month. The first technical session was held at the Van Orman Hotel on November 11th, with a dinner preceding the meeting, and was well attended. The speaker of the evening was Wilbur Deutsch of the Trabon Engineering Co., Cleveland, who spoke on "Various Uses and Benefits of Automatic Lubrication Systems," also touching on the safety features. Mr. Deutsch's talk, which was accompanied by slides, was provocative of considerable discussion. The Fort Wayne Section has shown rapid progress and has increased its membership to a remarkable extent.

(*Continued on page* 272)

A.S.L.E. Section Officers

Baltimore:
Chair., V. A. Ryan, Crown Cork & Seal Co., Inc., Eastern Ave. & Kresson St., Baltimore 3, Md.
V. Chair., A. E. Cichelli, Bethlehem Steel Company, *802 E Street, Sparrows Point 19, Md.
Secy.-Treas., P. Raymond Staines, The Davison Chemical Corp., Curtis Bay Plant, Baltimore 3, Md.

Boston:
Chair., A. E. Baker, Jr., Thomson Laboratory, General Electric Co., River Works, 920 Western Ave., West Lynn 3, Mass.
V. Chair., D. F. Wilcock.
Secy.-Treas., R. B. Lewis, Shell Oil Co., Inc., 441 Stuart St., Boston 16, Mass.

Buffalo:
Chair., J. E. Farry, Alemite Co., *348 Florida Ave., Buffalo, N. Y.
Co-Chair. (U.S.A.), C. L. Pope, Eastman Kodak Co., Kodak Park, Rochester 4, N. Y.
Co-Chair. (Canada), G. T. Wright, Dominion Foundries & Steel, Ltd., Depew St., Hamilton, Ontario, Canada.
Secy., N. C. Morrell, Eastman Kodak Co., 333 State St., Rochester 4, N. Y.
Treas., G. Findlay, Republic Steel Corp., 1175 S. Park Ave., Buffalo 20, N. Y.

Chicago:
Chair., Carl E. Schmitz, Crane Packing Co., 1800 Cuyler Ave., Chicago 13, Ill.
V. Chair., Robert A. Kraus, Republic Steel Corp., 116th and Burley Sts., Chicago, Ill.
Secy.-Treas., Charles F. Garney, Socony-Vacuum Oil Co., Inc., *Route 2, Box 526, Des Plaines, Ill.

Cleveland-Youngstown:
Chair., Edwin Crankshaw, Cleveland Graphite Bronze Co., 17000 St. Clair St., Cleveland 10, Ohio
V. Chair., Charles A. Geisinger, B. F. Goodrich Co., 500 S. Main St., Akron 18, Ohio
Secy., Charles H. Frazier, The Torrington Co., 16004 Detroit Ave., Cleveland 7, Ohio
Treas., J. W. Kasmark, Lincoln Engineering Co., *596 E. 103rd St., Cleveland, Ohio

Connecticut:
Chair., C. R. Gillette, New Departure Division, General Motors Corp., *Vanderbilt Road, Bristol, Conn.
V. Chair., F. E. Stockwell, Esso Standard Oil Co., *40 Elmwood Road, New Haven 15, Conn.
Secy.-Treas., C. A. Pethybridge, New Britain Machine Co., *107 Pendleton Road, New Britain, Conn.

Dayton:
Chair., R. F. McKibben, National Cash Register Co., *241 N. Smithville Rd., Dayton 3, Ohio
Secy., H. L. Sellers, Shell Oil Co., Inc., 700 N. Euclid Ave., Dayton 7, Ohio.

Detroit:
Chair., P. W. Uhl, Detroit Diesel Engine Div. G. M., 13400 W. Outer Dr., Detroit 23, Mich.
V. Chair., P. D. Wright, Motor Transport Division, City of Detroit, 2650 E. Jefferson Ave., Detroit 7, Mich.
Secy., J. W. Hopkinson, Penn-Petroleum Corp., 7131 Westfield at Burnette, Detroit 4, Mich.
Treas., B. B. Phelps, Honan-Crane Corp., *2156 Cadillac Blvd., Detroit 4, Mich.

Fort Wayne:
Chair., N. H. Schell, International Harvester Co., Fort Wayne Works, Pontiac & Bueter Rd., Fort Wayne, Indiana.
V. Chair., Franklin Buckner, Alemite Company, *514 W. Ohio St., Bluffton, Indiana.
Secy.-Treas., J. S. Michell, Shell Oil Co., *2112 St. Joe Blvd., Fort Wayne, Indiana.

Indianapolis:
Chair., D. H. Wilson, Continental Steel Corp., South Plant, Kokomo, Indiana.
Secy.-Treas., J. E. Burns, Jr., Crescent Oil Co., 514 W. Wyoming St., Indianapolis 2, Ind.

Los Angeles:
Chair., Milton A. Wise, General Petroleum Corp., 108 W. 2nd St., Los Angeles 12, Cal.
V. Chair., Peter Kyropoulos, California Inst. of Technology, 1201 E. California St., Pasadena 4, Cal.
Secy.-Treas., Richard L. Engel, Allis-Chalmers Mfg. Co., *800 S. Abbot Ave., San Gabriel, Cal.

Milwaukee:
Chair., Alvin E. Boie, Allis-Chalmers Mfg. Co., *6921 W. Rogers St., West Allis 14, Wisc.
V. Chair., Richard D. Bussard, Ladish Co., 5481 S. Packard, Cudahy, Wisc.
Secy., H. P. Hofmeister, Socony-Vacuum Oil Co., *2355 N. 82nd St., Wauwatosa, Wisc.
Treas., Darryl W. Johnson, Standard Oil Co., 414 W. Michigan St., Milwaukee 1, Wisc.

A.S.L.E. National Committee Chairmen

Awards:
T. B. RYAN
Dingle-Clark Co.
Philadelphia 3, Penna.

By-Laws:
D. E. WHITEHEAD
Carnegie-Illinois Steel Co.
Pittsburgh, Pa.

Education and Training Program:
D. D. FULLER
Dept. of Mechanical Engineering
Columbia University
New York 27, N. Y.

Finance:
B. H. JENNINGS
Northwestern Technological Institute
Evanston, Ill.

Industrial Membership:
W. F. LEONARD
Room 1708, 343 S. Dearborn St.
Chicago 4, Ill.

Membership:
Co-Chairman, FRANK ROSS
E. F. Houghton & Co.
Cleveland 3, Ohio
Co-Chairman, WM. P. YOUNGCLAUS
2114 Fir St.
Glenview, Ill

New Sections:
NATIONAL OFFICE
Chicago 4, Ill.

Program, Planning and Publications:
Co-Chairman, ALLEN F. BREWER
The Texas Co.
New York 17, N. Y.
Co-Chairman, M. E. MERCHANT
Cincinnati Milling Machine Co.
Cincinnati 9, Ohio

Project and Publicity:
E. M. KIPP
Aluminum Research Labs.
New Kensington, Pa.

Membership in the Society is in several grades as defined below. Assignment to grade is made by the Admissions Committee or Board of Directors on the basis of information submitted or supplied by references.

MEMBERS—$12.50

Members shall be: (1) persons not less than twenty-four years in age who are engaged in research and instruction at technical schools, universities and various publicly and privately supported institutions in the field of lubrication; or (2) persons not less than twenty-four years in age who have occupied recognized positions as Lubrication Engineers for a period of three or more (not necessarily consecutive) years prior to date of admission, involving the responsibility for or supervision of the development, selection, field use and application of lubricants as differentiated from other activities; or (3) persons not less than twenty-four years in age who are indirectly concerned with the field of lubrication, but possessing other qualifications of experience, knowledge and accomplishment, have manifested a particular interest in the purposes and welfare of the Society, to the extent that their membership would be a valuable contribution to the successful functioning of its activities.

JUNIOR MEMBERS—$6.25

Junior Members shall be: persons less than twenty-four years in age, and those who do not completely fulfill the membership requirements for Members.

INDUSTRIAL MEMBERS

Industrial members are such persons or organizations as may be interested in and desire to contribute to supporting the purposes and activities of the Society. The fees paid by an industrial member in general will not be allowed to exceed $200.00 per year.

New York:	Chair., W. E. Campbell, Bell Telephone Laboratories, Murray Hill, New Jersey V. Chair., Edward H. Erck, Bendix Aviation Corp., Teterboro, New Jersey. Secy., John C. Vangundy, The Texas Co., 135 E. 42nd St., New York 17, N. Y. Treas., Aubrey Setzer, Colgate-Palmolive-Peet Co., *P. O. Box 124, Metuchen, New Jersey
Northern California:	Chair., H. G. Isbell, Industrial Laboratory, U. S. Navy Yard, Mare Island, Cal. V. Chair., John Boyce, Food Machinery Corp., *1770 Cleveland Ave., San Jose, Cal. Secy.Treas., A. S. Horwitz, E. F. Houghton & Co., Quint & Davidson Sts., San Francisco, Cal.
Philadelphia:	Chair., W. P. Kuebler, Westinghouse Electric Corp., *2334 Franklin Ave., Secane, Pa. V. Chair., D. F. Hollingsworth, E. I. du Pont de Nemours & Co., 1007 Market St., Wilmington 98, Del. Secy., K. E. Simminger, Bowser, Inc., 521 Arch St., Philadelphia 6, Pa. Treas., J. L. Beatty, L. R. & J. L. Beatty, 2005-13 W. Bellevue St., Philadelphia 40, Pa.
Pittsburgh:	Chair., W. E. Elliott, Carnegie Illinois Steel Co., *837 Middle, North Braddock, Pa. V. Chair., Wayne S. Fuhr, Hanna Coal Co., *RFD No. 1, Bridgeport, Ohio Secy.-Treas., H. A. Goddard, Gulf Oil Corp., Gross St. & P. R. R., Pittsburgh 6, Pa.
St. Louis:	Chair., J. F. Palmer, Jr., Monsanto Chemical Co., 1700 S. 2nd St., St. Louis 4, Mo. V. Chair., T. V. Picraux, Lincoln Engineering Co., 5703 Natural Bridge Ave., St. Louis 20, Mo. Secy.-Treas., Henry M. T. Harris, National Bearing, Div. Brake Shoe, *2837 Manderly, Brentwood 17, Mo.
Twin Cities:	Chair., Chas. I. Kraus, Alemite Co. of Minnesota, 1226 Harmon Place, Minneapolis 3, Minn. V. Chair., E. H. Lindemann, Minneapolis Honeywell, 2753—4th Ave., So., Minneapolis, Minn. Secy.-Treas., J. H. Richards, E. F. Houghton & Co., 822 Plymouth Bldg., Minneapolis 2, Minn.

*Denotes Residence Address Preferred.

Boston, the oldest large city in the United States, was founded in 1630, by a chartered company of English colonists under the Governorship of John Winthrop. Among its many "firsts" in American history were: the establishment of the first American printing office, the first regular newspaper, and America's first public school. Boston is well called "The Birthplace of the American Nation." It possesses a wealth of historic places and traditions which are the heritage of all America. Its position as the natural center of New England remains unchallenged. With its railroad, ocean and airline shipping facilities, and the wealth of a greatly diversified industry, Boston and New England have a tremendous future. The "Yankee ingenuity," which has been responsible for its technological advancement, is a dominating factor. We predict our new A. S. L. E. Boston Section will, by reflecting the same qualities of industry and enterprise, become as outstanding as the city of which it is a part.

NEWS OF THE SECTIONS

(*Continued from page* 270)

INDIANAPOLIS

Mr. E. B. Fremon, Chief Lubrication Engineer of the St. Louis Division of Socony-Vacuum Co., spoke before the regular meeting of the Indianapolis Section, October 25th, on the subject of "Conservation of Oils." Mr. Fremon's talk was accompanied by projected reprints and diagrams, and was very well received. This Section had planned a series of meetings which will be announced in the next edition of the Journal.

LOS ANGELES

The September 14th meeting of this Section was held at The Ethyl Corp. in this city. Mr. J. M. Stokely, Senior Research Engineer of the California Research Corp., gave an able discussion on "A New Performance Test for Cutting Fluids," describing the development of a new performance test which has proved to be an excellent means for evaluating such fluids rapidly and accurately. After a short business session, the meeting was adjourned.

MILWAUKEE

Mr. M. P. Sonn, Manager, Bus & Truck Division, Socony-Vacuum Oil Co. of Milwaukee, spoke at the October 18th meeting of the Milwaukee Section, at the Engineers' Society of Milwaukee. Subject: "What Everyone Should Know About the Lubrication of His Automobile." Dr. L. Heard, Director of Exploratory Research at Standard Oil Co. of Indiana, spoke at the regular November 15th dinner meeting on "Romance of Petroleum Refining." The December meeting is scheduled to be held as a Christmas party with refreshments and prizes.

ST. LOUIS

The first fall meeting of this Section was held September 21st, at Garavelli's Restaurant. Mr. Sherod L. Earle, of the U. S. Naval Engineering Station, Annapolis, Md., spoke on "Lubricating Oil Filters and Filter Testing," describing the methods used by the Station for various tests. Mr. Earle illustrated his talk with various slides and samples of filter elements and materials. On October 28th, there was a joint meeting with the A.S.M.E. at the Engineers' Club at 8:00 p. m. Mr. J. R. Carlson, Manager Steam Application Division, Westinghouse Electric Corp., discussed the subject of "Gas Turbines" before an audience of 250. The regular technical session was held Tuesday evening, November 9th.

The National Secretary, while in St. Louis, spent a day at the Lincoln Engineering Company, and after an enjoyable conversation with their President, Mr. Alex P. Fox, was taken for a tour of their extensive plant.

Our thanks go to Mr. T. V. Picraux, Sales Manager of Lincoln, and his able assistant, Mr. Alvie Woodland. Another day was spent at the offices and plant of the Monsanto Chemical Company, where the fine hospitality of Dr. J. F. Palmer, Jr., was enjoyed. The amazing results produced by this plant are beyond description. An inspection of their combined laboratories results in the feeling that if there is anything further to be discovered regarding additives for lubricants, there is the place for it. The combined session of the A.S.M.E. and the A.S.L.E. that evening rounded out a very interesting and profitable stay in St. Louis.

(*Continued on page* 278)

OILS AND LUBRICANTS PATENT ABSTRACTS

Printed copies of patents are available from the Patent Office at twenty-five cents each. Address the Commissioner of Patents, Washington D. C., for copies and for general information concerning patents.

From Official Gazette—Vol. 614, Nos. 1, 3, 4. Vol. 615, Nos. 1, 2, 3, 4.

Prepared by ANN BURCHICK

Grease Compositions—Patent #2,448,567—William A. Zisman and George M. Hain.

A lubricant comprising from about 95% to about 80% by weight of a branched-chain alkyl di-ester of a carboxylic acid having from five to twelve carbon atoms per molecule blended with from about 5% to about 20% by weight of a soap to produce a stable grease, the sum of the percentages of these ingredients totaling 100%.

Novel Greases—Patent #2,448,720—Francis J. Licata, assignor to Nopco Chemical Co.

A lubricating grease comprising mineral oil, 2% to 20% of an aluminum soap of a saturated higher fatty acid and 0.1% to 5.0% of a barium soap of a higher fatty acid, the quantity of the barium soap being only a fraction of that of the aluminum soap.

Aluminum Soap Grease—Patent #2,448,721—Francis J. Licata, assignor to Nopco Chemical Co.

A lubricating grease comprising mineral oil, 2% to 20% of an aluminum soap of a saturated higher fatty acid and 0.1% to 5.0% of a heavy metal soap selected from the group consisting of iron, cobalt, nickel, zinc and copper soaps of higher fatty acids, the quantity of heavy metal soap being only a fraction of that of the aluminum soap.

Rust-Inhibiting Lubricant—Patent #2,449,025—William R. Turner, assignor to The Atlantic Refining Co.

A rust-inhibiting lubricant comprising hydrocarbon lubricating oil, 0.25% to 3% of an alkaline earth metal petroleum sulfonate, and 0.01% to 3% of a pure aliphatic alcohol containing at least 5 carbon atoms.

Lubricating Oil Addition Agent—Patent #2,449,547—Gordon D. Byrkit, assignor, by mesne assignments, to The Lubrizol Development Corp.

As a hydrocarbon lubricating oil improving agent, a halogen-bearing synthetic material obtained by the condensation of a homogeneously halogenated waxy ester with an anhydrous metal salt of a carboxylic acid, said waxy ester being selected from the class consisting of naturally occurring solid and semi-solid waxy esters and synthetic carboxylic acid solid and semi-solid waxy esters, said homogeneously halogenated waxy ester containing a uniform number of halogen atoms per molecule, and said condensation reaction being carried out with an amount of the anhyrous metal salt insufficient to replace all of the halogen in said homogeneously halogenated waxy ester.

Lubricating Grease Composition—Patent #2,449,580—Alan Beerbower and John C. Zimmer, assignors to Standard Oil Development Co.

Process for preparing a lubricating grease which comprises thoroughly mixing at a temperature sufficiently high to cause the soap to dissolve in the oil, a viscous hydrocarbon oil, grease forming proportions of an aluminum soap of a saturated fatty acid containing between about 10 and 22 carbon atoms in the molecule, and 0.075 to 3% of resorcinol based on the total composition, rapidly cooling the heated mixture in a flowing stream by artificial chilling substantially below the normal transition temperature of about 140°F., and then allowing the mass to stand.

Oil Composition—Patent #2,449,631—John C. Zimmer and Raphael Rosen, assignors to Standard Oil Development Co.

A composition of matter consisting essentially of an oleaginous vehicle with a tendency to foam during processing use or manufacture, and 0.0001 to 10% by weight of a foam inhibiting additive consisting essentially of a liquid non-volatile polymer of a chlorofluoro substituted olefin of 2 to 10 carbon atoms, said polymer containing 10 to 50 carbon atoms per molecule and having a major part of its normal hydrogen content replaced with said halogens.

Lubricant—Patent #2,449,689—Paul H. Carnell, assignor to Phillips Petroleum Company.

A composition for the lubrication of valves used in service where an acid selected from the group consisting of HCl and HF is in process consisting of a chlorinated paraffin wax prepared from a paraffin wax having a melting point between approximately 125° and 130°F. and containing about 42% by weight of chlorine, and sufficient solid thickening agent selected from the group consisting of graphite and asbestos to impart a desired consistency to the lubricant composition to effectively seal valves lubricated with said composition against leakage when used in said service.

Mineral Oil Composition—Patent #2,449,934—John J. Giammaria, assignor to Socony-Vacuum Oil Co., Inc.

An improved mineral oil composition comprising a viscous mineral oil fraction having in admixture therewith a minor proportion, sufficient to inhibit said oil fraction against the deleterious effects of oxidation, of an oil-soluble, acidic, phosphorus—and sulfur-containing reaction product obtained by: reacting an alkyl halide and a phosphorus sulfide in the presence of a Friedel-Crafts catalyst at an elevated temperature between about 125°C. and about 250°C.; and separating said acidic reaction product so formed from the reaction mixture obtained in the reaction.

Block Grease Compositions—Patent #2,450,149—Paul R. McCarthy, assignor to Gulf Research & Development Co.

An improved block grease possessing anti-charring and anti-glazing properties and having a low consumption factor comprising an intimate anhydrous mixture of about 50% to about 80% of a mineral oil of about 100 SUS/100°F. to about 500 SUS/100°F. and about 50% to about 20% of soap base, the said base comprising approximately equal quantities of a soap of a hydrogenated rosin of at least about 40% saturation and a fatty acid soap, and a diarylamine in an amount sufficient to substantially inhibit oxidational deterioration.

Texture-Stable Lithium Base Grease—Patent #2,450,219—Harry V. Ashburn and Oney P. Puryear, assignors to the Texas Co.

A method of preparing at temperatures attainable in a steam-jacketed kettle a texture-stable gel-type grease consisting of lithium soap as the entire soap content thereof, said lithium base grease being resistant to substantial lowering in consistency when subjected to high shearing stresses of the character hereindescribed, as well as being resistant to substantial hardening after being subjected to said high shearing stresses, which comprises saponifying with a basic lithium compound at a temperature of about 170-200°F. of a blend of a major proportion of a soap-forming essentially saturated hydroxy fatty acid glyceride and a minor but substantial proportion of a soap-forming saturated fatty acid, the latter being sufficient in amount to prevent any material increase in consistency due to high shearing stress of the final grease product referred to hereinbelow, as determined by a decrease of not more than a few points in the miniature penetration values obtained before and after subjecting the said grease to the described dynamic shear test, then heating the resulting saponified reaction product above about 270°F. but not substantially above 300°F. for a period of time to dehydrate the product and render the same translucent, then reducing the heat and adding an oleaginous vehicle to the dehydrated product as the latter cools to at least about 200°F. and the desired consistency is obtained, and finally drawing the resultant mix to obtain a glossy buttery homogeneous gel-type grease as a final product.

Texture-Stable Lithium Base Grease—Patent #2,450,220—Harry V. Ashburn and Oney P. Puryear, assignors to The Texas Company.

A method of preparing at temperatures attainable in a steam-jacketed kettle, a texture-stable and water-resistant gel-type grease consisting of lithium soap as the entire soap content thereof, said lithium base grease being resistant to substantial softening and also resistant to substantial hardening when subjected to high shearing stresses of the character herein described, which comprises saponifying with a basic lithium compound at a mildly elevated temperature a blend consisting of 35-50% by weight of a soap-forming hydroxy fatty acid, and 65-50% by weight of a soap-forming saturated fatty acid, then heating the resulting saponified reaction product to a higher temperature not substantially exceeding about 310°F. to dehydrate the same, thereafter lowering the temperature and adding an oleaginous vehicle as the product cools and until the desired consistency is obtained, and finally drawing the resulting mix to obtain the texture-stable and water resistant gel-type grease as a final product.

Shear-Resistant Grease—Patent #2,450,221—Harry V. Ashburn, Robert S. Barnett, and Oney P. Puryear, assignors to The Texas Co.

A lubricating grease composition comprising as the essential and at least major portion of the lubricating base a high molecular weight high-boiling liquid aliphatic dicarboxylic acid ester within the lubricating oil viscosity range and possessing lubricating properties, and sufficient metal soap of a soap-forming fatty material selected from the group consisting of hydroxy fatty acids and hydroxy fatty acid glycerides to thicken said lubricating base, said grease composition being texture-stable under high shearing stress.

Shear-Resistant Greases—Patent #2,450,222—Harry V. Ashburn, Robert S. Barnett, and Oney P. Puryear, assignors to The Texas Co.

A lubricating grease composition comprising as the essential and at least major proportion of the lubricating base an oil-soluble high molecular weight high-boiling liquid aliphatic dicarboxylic acid ester within the lubricating viscosity range and possessing lubricating properties, and sufficient lithium soap of soap-forming fatty material to thicken said lubricant base, said soap-forming fatty material consisting of more than 50% by weight of a hydroxy soap-forming fatty material selected from the group consisting of hydroxy fatty acids and hydroxy fatty acid glycerides, said grease composition being texture-stable under high shearing stress.

Method of Preparation of Barium Soap Greases—Patent #2,450,224—Eric A. Bergmann, Harry V. Ashburn, and George W. Eckert, assignors to The Texas Co.

A method of preparing a normal barium soap composition which comprises saponifying a soap-forming fatty acid with not more than the stoichiometric equivalent of barium hydrate in the presence of a mineral oil possessing a VGC of at least 0.870 to produce a saponification product of normal barium soap, dehydrating the saponification product at temperatures not in excess of the melting point of the soap base, cooling the dehydrated product with continuous stirring to a temperature below the critical transition temperature of the grease base without reducing the concentration of the soap component to substantially below 40%, thereafter adding mineral lubricating oil to obtain the desired consistency and drawing the resulting grease composition.

Rust-Inhibiting Greases—Patent #2,450,321—Ernest T. White and Reuben Carl Robinson, assignors to Socony-Vacuum Oil Co., Inc.

An alkali metal rust-inhibiting grease comprising a major proportion of a mineral oil, an alkali metal soap present in sufficient proportion to thicken said oil to a grease consistency, and between about 0.5 and about 2 per cent by weight of a compound having the general formula:

$$Y—R—O(CH_2CH_2O)_5—H$$

where R represents an aromatic nucleus and Y is a member selected from the group consisting of aliphatic, cycloaliphatic, arylaliphatic and aryl hydrocarbon radicals having at least four carbon atoms.

Mineral Oil Composition and Improving Agent Thereof—Patent #2,450,405—Henry G. Berger, Thomas T. Noland and Everett W. Fuller, assignors to Socony-Vacuum Oil Co., Inc.

An improved mineral oil composition comprising a mineral oil fraction having in admixture therewith a minor proportion, sufficient to enhance the stability of said mineral oil fraction, of a stable, oil-soluble, phosphorus-, and sulfur-containing reaction product obtained by reaction of phosphorus pentasulfide and a thermal cycle stock at a temperature between about 125°C. and about 200°C. for a relatively short reaction time whereupon a stable, oil-soluble product is obtained, said cycle stock being characterized by an olefin content of from about 3% to about 7% and an aromatic content of from about 40% to about 60%, and the said phosphorus pentasulfide representing from about 1% to about 8% by weight of the said cycle stock.

Desulfurization of Oils—Patent #2,450,588—Bernard L. Evering, Arthur P. Lien, and James M. Page, Jr., assignors to Standard Oil Company.

The method of selectively desulfuryzing a non-viscous aromatic-containing hydrocarbon oil comprising contacting said oil with a solvent consisting of liquid anhydrous hydrogen fluoride at a temperature within the range of about 300°F. to about 400°F., flashing off any hydrocarbon gases and hydrogen sulfide resulting from the conversion of sulfur compounds in said oil, cooling the flashed mixture of hydrocarbons and hydrogen fluoride to a temperature of from about 0°F. to about 212°F., contacting the cooled mixture with additional liquid anhydrous hydrogen fluoride while maintaining a pressure sufficient to maintain the solvent and hydrocarbon oil in the liquid phase, permitting the mixture of said oil and liquid hydrogen fluoride to stratify into an aromatic-containing raffinate phase substantially free of sulfur and sulfur-containing extract phase, separating said phases and removing the hydrogen fluoride from said phases.

Phosphorus Acid Esters of Petroleum Phenols—Patent #2,450,903—Louis A. Mikeska, assignor to Standard Oil Development Co.

Liquid phosphorus acid esters of petroleum phenols having at least 11 carbon atoms and boiling above 150°C. at 6mm. pressure, said esters being soluble in hydrocarbon oils at room temperature in all proportions.

Method of Refining Lubricating Oils—Patent #2,451,-

(*Continued on page* 276)

TRICO AUTOMATIC OILERS
REG. U.S. PAT. OFF.

PROVIDE A *SURE* WAY TO REDUCED MAINTENANCE COST AND LONGER MACHINE LIFE

From the moment you install TRICO Automatic Oilers, you are assured of positive, worry-free lubrication. Daily hand-oiling is completely eliminated and the savings in oil, less down-time and longer machine life will repay their cost many times over.

TRICO
OPTO-MATIC OILER
WITH GLASS BOTTLE

Automatically maintains a constant level of oil in ring or ball bearing, gear and pump housing, etc. . . . Oil supply is always visible . . . ONE filling lasts a LONG time. Easily installed.
WRITE FOR BULLETIN 24-B

TRICO
OPTO-MATIC OILER
WITH UNBREAKABLE PLASTIC BOTTLE

Includes all the same precision engineering features as the above, except that, where the use of glass is impractical, a reinforced unbreakable plastic bottle is provided and assures crystal clear visibility.
WRITE FOR BULLETIN 25-C

TRICO
GRAVITY-FEED OILER
WITH UNBREAKABLE PLASTIC BOTTLE

The World's finest and most dependable Gravity-feed Oiler. Feeds any pre-determined number of drops per minute. Standard and Dust-proof models. Has removable oil filter, sight feed, and is easily installed.
WRITE FOR BULLETIN 26-B

TRICO
THERMAL OILER
SIDE-MOUNT AND STANDARD STYLES

For Wick and Waste-packed bearings. Feed automatically when bearing heats . . . Stop when bearing cools . . . Has crystal clear reinforced plastic bottle.
WRITE FOR BULLETIN 28-C

TRICO
WICK FEED OILER

Visible, automatic lubrication for solid, wick and waste-packed bearings, with re-inforced plastic bottle . . . Offers FOUR TIMES the capacity of ordinary oil cups. Sight feed . . . Oil supply is always visible.
WRITE FOR BULLETIN 27-A

TRICO FUSE MFG. CO. Milwaukee 12, Wis.
In Canada—IRVING SMITH LIMITED—Montreal

ANTIFRICTION BEARING DEVELOPMENTS

Discussion by T. E. ROUNDS

(*Continued from page* 256)

the grease churned violently. This installation is very carefully designed to prevent the entrance of foreign matter into the bearings by very close running labyrinth seals, and furthermore, the air flow is directed so as to keep the housing parts very cool.

Another manufacturer is operating sizes No. 103 and No. 203 on a vertical spindle with grease lubrication, the drive being a high frequency induction motor at speeds of 54,000 to 60,000 rpm. These bearings run somewhat warmer than in the previous example, being successfully lubricated by a controlled grease lubrication system.

Grease lubrication of horizontal very high speed spindles has not been entirely successful. Some of the difficulties have been due to the very distinct tendency of some spindle mountings to run with reduced internal air pressures. On one of our own installations we found that the air pressure within the spindle housings ran at a pressure of two to four inches of water below atmospheric. Attempts made to grease lubricate these units failed miserably in a few hours as grinding dust and coolant was drawn into the bearings, causing rapid wear. In some cases it has been noticed that bearings have been washed clean of grease due to the entrance of soluble oil type coolants. Obviously, in such cases, unless positive seals can be used on grease lubricated high speed spindles, good results cannot be experienced due to the tendency of some housings to "inhale."

Adequate grease storage is essential. Grease in thin films tends to deteriorate rapidly, leaving only soap deposits behind. Oil feed from the grease to the bearing surfaces must be continuous and positive.

Obviously grease used on very high speed spindle bearings must be of very high quality. Considerable progress has been made by a number of the lubricant manufacturers in recent years along these lines. We have found that some greases manufactured to certain Government specifications are quite satisfactory. We refer particularly to the need for high oxidation and good mechanical stability through a wide temperature range as well as a minimum oil loss due to vaporization. The products must be good lubricants and of course, free from foreign matter and abrasives.

In closing, the writer wishes to commend highly the excellent work already accomplished by several well known manufacturers of ball bearing grease lubricants whose products have shown remarkable performance where these products have been intelligently applied and properly handled.

NEW SCHOOL FOR LUBRICATION IN ITALY

(*Continued from page* 265)

One purpose of the school is to convince engineers that this rebuilding is possible and to instruct technicians how to do it. Another and more far-reaching purpose is to enlighten engineers and technicians as to the proper designing, construction and maintenance of lubricated machine parts, and in particular to diagnose failures so that they may be corrected in future designs.

This will require abandonment of the usual method in practice of adapting the available lubricant to the requirements of the bearing, and substituting instead the logical method of designing the bearing for the best available lubricant. The latter method is rational since lubricants are natural products and their properties cannot be changed materially, while bearings are artificial parts and can be formed to suit the designer.

There are schools for consumers of metals, electricity, and chemicals, but none for the users of lubricants. In Italian engineering schools, lubrication theory is briefly discussed but in an uninteresting manner, and with little reference to practical applications. There is no published treatise on lubrication in the Italian language; even the technical articles are few in number and are neither general enough nor written clearly nor simply enough to be of much use to the average engineer. Practically all of the available literature was published by lubrication companies but it was written more for the advertisement of the lubricant than for the education of the user.

With this situation facing Italian industry, the school was planned in 1940 but its opening was delayed on account of the war. However, in 1943, the "Scuola della Lubrificazione" was established and has had classes each year to date.

The school is regarded not as an end in itself, but as a complemental school for the professional ones: mechanical, electrical, chemical, automotive, and aeronautical, and treats lubrication as a science which embraces the general laws of kinematics, dynamics, hydrodynamics, elasticity, thermodynamics and organic chemistry.

During the war, classes were held at manufacturing plants and on the military field, including the active fighting front. At the present time, classes are held on the premises of the plants where the men attending the school are employed. The school is intended to serve both producers and users of lubricants, and the companies represented in the classes are manufacturing, shipping, dockyards, and machinery factories. The men attending the school are mechanical, naval and electrical men in the professions of engineers, technicians and salesmen.

The school is supported financially by the National Institute of Industrial Laboratories, and has had the support of lubrication companies. The industrial companies encourage their men to attend the classes and share the cost.

The only published educational literature on lubrication in the Italian language is the lessons of the school, but now a treatise on lubrication is needed.

One of the major objectives of the school is to encourage the publication of such a treatise, and to promote the publication of a complete and systematic history of lubrication as a science and an art. It is also planned to form an organization similar to our A.S.L.E. which will be named T.E.L.L. (Technicians and Experts in Lubricants and Lubrication).

It is apparent that the leaders in the field of lubrication in Italy believe that the useful life of machines can be prolonged materially by proper design of parts which are subjected to wear, and that the proper design of these parts should include a consideration of all the factors involved, including the properties of the lubricant, as well as the interrelated laws of kinematics, dynamics, hydrodynamics, elasticity, thermodynamics, and organic chemistry.

Grafo **COLLOIDAL GRAPHITE**

INDUSTRIAL PRODUCTION

for—HOT or COLD FORGING, DRAWING AND STAMPING • ASSEMBLY and RUN-IN • HIGH and LOW TEMPERATURES • IMPREGNATION and PARTING • ALL RUBBING and SLIDING SURFACES.

"Grafo" Colloidal Graphite may be obtained in water, petroleum oil and castor oil, in concentrated, semi-concentrated and ready-for-use mediums.

Write Us Regarding Your Special Applications

Grafo **PRODUCE MORE—FASTER—BETTER**

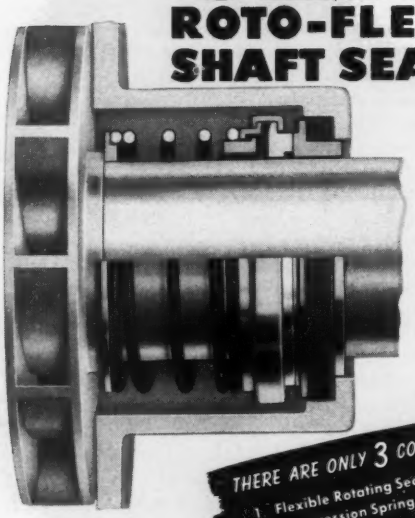
GRAFO COLLOIDS CORPORATION

Other Industrial Uses:
DIE CASTINGS
MOLD COATINGS
STEAM CYLINDERS
WIRE DRAWING
PARTING COMPOUNDS
IMPREGNATION
PLASTICS
CORROSION RETARDANT
RESISTANCE ELEMENTS
STATIC CONTROL
CONDUCTIVE COATINGS
EXTREME PRESSURES

360 WILKES PLACE
SHARON, PENNSYLVANIA

ADVANCED DESIGN in SHAFT SEALING

GITS ROTO-FLEX SHAFT SEAL



ADVANCED DESIGN . . . Key to the development of Gits Bros. new ROTO-FLEX SHAFT SEAL. And back of this development lies the detailed research and experience gained by Gits Engineers over many years of designing and manufacturing high speed shaft seals.

The advanced design features of the Gits Roto-Flex Shaft Seal include:

1. No loose parts—permanently assembled Seal Nose.
2. Positive built-in flexibility.
3. Torque washer that relieves diaphragm strain.
4. Balanced design—Minimum spring pressure.
5. Machine-lapped seal surfaces.
6. Easy installation due to extreme construction simplicity.

AVAILABLE SINGLE OR DOUBLE. Where liquid must be added as coolant or lubricant, Gits Roto-Flex is also available in double unit.

The need for the Gits Roto-Flex Shaft Seal is unlimited and UNTIL NOW not fully answered. For proper recommendations on your seal problem, send a dimensioned drawing, showing where the seal is to be applied, for immediate and careful attention by Gits Bros. Engineers. Also include such operating data as:

1. Shaft R.P.M. and direction.
2. Liquid or gas being sealed.
3. Temperature range.
4. Pressure range.

and any special details related to design or assembly. On any shaft sealing problem—as on any lubricating problem—it will pay you to consult with Gits Bros. . . . "Friction-Fighting Headquarters" for over 40 years.

WRITE TODAY for new literature which graphically describes the new Gits Roto-Flex Shaft Seal. Engineering data and many helpful suggestions included. It's Free!

GITS BROS. MFG. CO.

1876 South Kilbourn Avenue, Chicago 23, Illinois

Exclusive Manufacturers of Lubricating Devices for over 40 Years

Visit Us—Booth 560 at the Power Show, N.Y. Nov. 29 to Dec. 4

PATENT ABSTRACTS

(*Continued from page 273*)

025—Harold L. Ellender, assignor to Standard Oil Development Co.

A process for refining mineral lubricating oils having a neutralization value greater than 1.0 milligram of KOH per gram of oil which comprises intimately contacting a mineral oil comprising lubricating oil fractions and organic acids naturally occurring therein with an alkaline reagent to form a substantially neutralized mineral oil, passing the neutralized mineral oil in a stream to a distillation zone and continuously distilling to form a lubricating oil distillate, adjusting the amount of alkaline reagent to obtain a distillate having a neutralization value of about 1.0 milligram of KOH per gram of distillate, extracting said distillate with phenol to form a raffinate phase and an extract phase, separately removing the phases and recovering an improved lubricating oil from said raffinate phase.

Lubricating Oil—Patent #2,451,037—Rush F. McCleary and Stiles M. Roberts, assignors to The Texas Company.

An improved lubricant comprising a major proportion of a mineral lubricating oil having incorporated therein a small proportion, sufficient to stabilize said oil, of an oil-miscible alkyl thiophenol methylene thioether.

Lubricant—Patent #2,451,039—Arnold J. Morway and John C. Zimmer, assignors to Standard Oil Development Co.

An improved lubricating grease composition comprising a major proportion of a low pour point lubricating mineral oil distillate, a minor proportion, sufficient to thicken said oil to a grease consistency, of a lithium soap of a saturated fatty acid and an aluminum soap of a saturated fatty acid, said aluminum soap being present in an amount substantially smaller than that of said lithium soap but not less than 0.25% of the total composition.

Lubricating Oil Addition Agents—Patent #2,451,048—William J. Sparks and Donald C. Field, assignors to Standard Oil Development Co.

The process for preparing a compound soluble in hydrocarbon oil which comprises reacting one part of an unsaturated high molecular weight essentially hydrocarbon polymeric material having an unsaturation greater than 25% as measured by the Kemp method for natural rubber and characterized by having a substantially aliphatic linear chain structure with the unsaturation interspersed along the chain as double bonds and by being capable of reacting with sulfur to give a product which has an elongation under tension of from 200% to 1200% at break, a forcible retraction upon release of the tension to the original dimension and shape and a tensile strength at break ranging between 500 lbs. and 5000 lbs. per sq. in., with 0.5 to 10 parts of a C_4 unsaturated hydrocarbon selected from the group consisting of isobutylene and butadiene, at a temperature between 20°C. and 40°C. in the presence of 0.2% to 5% by weight, based on the total reacting material, of an amphoteric metal halide polymerization catalyst in a highly dispersed fluid state.

Compounded Lubricating Oil—Patent #2,451,345—John G. McNab and Dilworth T. Rogers, assignors to Standard Oil Development Co.

A hydrocarbon material subject to deterioration by atmospheric oxygen containing a stabilizing amount of a product obtained by reacting a sulfide of phosphorus with a divalent group II metal salt of a compound having the characterizing structure

$$R—Ar(XH)—Y_x—R'$$

in which the groups R, XH and Yx—R' are all connected to the aromatic nucleus Ar, and in which R represents at least one alkyl group of 4 to 24 carbon atoms and R' represents an aryl group, X is an element of the group consisting of oxygen and sulphur, Y is a member of the sulfur family of elements, and x is an integer from 1 to 4, at a temperature of 100-200°C. for a period of at least 10 minutes, the proportions of reactants being such that from 0.03-2 atomic proportions of phosphorus are present for each atomic proportion of metal.

Compounded Lubricating Oil—Patent #2,451,346—John C. McNab and Dilworth T. Rogers, assignors to Standard Oil Development Co.

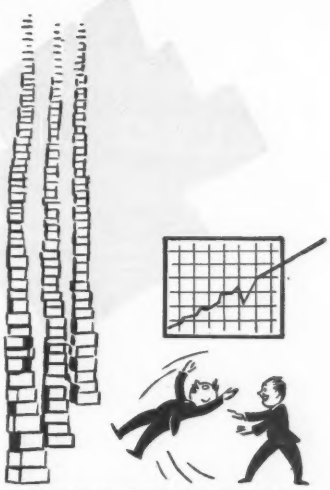
A petroleum hydrocarbon material containing a stabilizing amount of a product obtained by reacting a sulfide of phosphorus with a basic polyvalent metal salt of an acidic organic compound at a temperature of about 100°C.-180°C., for a period of at least 10 minutes, in the ratios of 0.05-2 atomic proportions of phosphorus for each metal atomic proportion of metal in the salt and 0.75-2.5 atomic proportions of sulfur for each atomic proportion of phosphorus.

Method of Determining the Rust-Preventing Properties of Lubricants—Patent #2,451,592—Carroll H. Van Hartesveldt, assignor to The Atlantic Refining Co.

A method for determining the rust-preventing properties of lubricant compositions, which comprises subjecting a ferrous metal test piece to the action of exhaust gas products of an internal combustion engine, then coating the test piece with the lubricant, exposing the coated test piece to air containing moisture, and noting the condition of the test piece after exposure.

WHY IT PAYS TO USE THE *RIGHT* CUTTING OIL

LONGER TOOL LIFE



HIGHER PRODUCTION

CLOSER TOLERANCE

BETTER FINISH

BETTER CHIP SEPARATION

SHELL HAS THE *RIGHT* CUTTING OIL FOR EVERY APPLICATION

SHELL KNOWS THE IMPORTANCE of using the right oil for a particular cutting job. That is why Shell Lubrication Engineers balance the oil to fit the machine . . . the application . . . and the tool.

Make sure the machines in your plant get the benefit of all that's new in lubrication. Call the Shell Lubrication Engineer. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

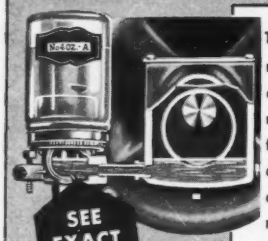
SHELL

SHELL CUTTING OILS

FOR METAL CUTTING AND GRINDING

DOWN go maintenance costs after installing

ACRO *Dual Visibility* LUBRICATORS



SEE EXACT oil level kept on bearing

These efficient "maintenance men" constantly hold the correct oil level to eliminate motor bearing failure due to faulty oiling. They save costly repairs . . . keep machines on the job. No drip, no waste, no splattering, pay for themselves in oil savings alone. ACRO LUBRICATORS operate six to twelve months without attention, immediately reduce maintenance costs.

Write for further interesting facts

- Easy to install
- Single adjustment
- Automatic feed
- No floats, no valves, no moving parts

ACRO Metal Stamping Co.

336 E. Reservoir Ave. • Milwaukee 12, Wis.

Sulphur and Chemical Additives

MODERN DEVELOPMENTS FOR THE

OIL AND METAL INDUSTRIES

BURNS LABORATORIES, Inc.

INDIANAPOLIS 2, INDIANA

514 - 520 WEST WYOMING STREET

Copy of this booklet available upon request.

NEWS OF THE SECTIONS

(*Continued from page* 272)

BALTIMORE

The fall season of the Baltimore Section was opened on September 24th, by Chairman Ryan, who introduced Mr. L. Bode, Superintendent of Equipment of the Baltimore Transit Co. Mr. Bode spoke on "Fleet Maintenance," and gave an interesting sidelight on his Army experiences in fleet maintenance and discussed the problems encountered in the operation of a city fleet such as a transit company, supplementing his remarks with a very interesting motion picture. The October 29th meeting of the Section was addressed by Mr. E. F. Koenig, Chemical Engineer of the Beacon Research Laboratories, the Texas Company, whose topic was "Factors Affecting Low Temperature Engine Deposits." A thirty-minute discussion period followed Mr. Koenig's presentation. Through last-minute difficulties, the program for November 19th has been changed. Mr. F. W. Spooner of Shell Oil Co. Lubricant Dept. of New York will speak on "All-Purpose Lubricants." Dr. Charles Waring, originally scheduled for November, will speak at the January 28th meeting.

The following calendar of events has been announced by the Baltimore Section:

Place—Sears Community Hall.
Time—8:00 P. M.

Dec. 29, 1948—Mr. W. C. Kesler, Lubrication Engineer, Crown Cork & Seal Co.: "Some Aspects of Lubrication."

Jan. 28, 1949—Dr. Charles Waring, Director of Research, Davison Chemical Corp.: "Refrigerator Maintenance and Lubrication.'

Feb. 25, 1949—Dr. J. M. Ramsay Socony-Vacuum Oil Co. of New York: "Additives."

Mar. 25, 1949—Mr. W. A. Murray, SKF Industries: "Anti-Friction Bearing Development."

Apr. 29, 1949—Mr. J. E. Rollins, Lubricants Dept. Mgr., Esso Standard Oil Co.: "Automotive Crank Case Oils and Fuels."

May 27, 1949—Mr. John Boyd, Research Laboratory, Westinghouse Elec. & Mfg. Co.: "Principles of Lubrication."

PITTSBURGH

The regular meeting of the Section was held at the Sheraton Hotel, Friday evening, October 15th, Chairman W. E. Elliott presiding. Mr. S. C. Griffith, Lubrication Engineer of the Jones & Laughlin Steel Corp., gave an interesting talk entitled "Some Observations on Steel Mill Lubrication." The November 19th session, at the same location, was addressed by Dr. E. S. Ross, Sun Oil Company, and Mr. M. D. Baker, West Penn Power Company. The combined subject was "What Central Station Users Expect of Turbine Oils and the Manner in Which These Properties Are Obtained by Refining."

SIGNIFICANCE OF CHEMICAL TESTS

(*Continued from page* 260)

Conclusions:

It is much easier to predict performance of an oil than it is to predict performance of a grease from the results of chemical tests.

While we have tried to explain some of the significance of chemical tests, we do not believe that every buyer of lubricants should be necessarily equipped to make such tests in his own plant.

To do so would often require more facilities than would ordinarily be justified. The manufacturer of the lubricant has had to determine many characteristics in order to satisfy the needs of many customers. He, therefore, probably either has at hand the information you may desire or has the testing facilities required to determine this for you.

May we in closing again point out the weakness of attempting to judge a lubricant by any single test. Chemical and physical tests are useful but actual performance is also required in order to determine a lubricant's value. We cannot too strongly emphasize that when one is in doubt as to how test results should be interpreted, he will always do well to consult his supplier.

This is the first of three papers presented at the Annual Convention covering Lubricant Test Methods and Their Interpretation. The remaining two papers will be published in the next issue and include the various discussions presented at the session.

Quality Lubricants for All Industrial and Automotive Applications

DIESEL ENGINES
STEAM ENGINES • TURBINES
PRODUCTION MACHINERY
METAL WORKING • PROCESSING
BUSES • TRUCKS
AUTOMOBILES • TRACTORS
CONSTRUCTION EQUIPMENT
FARM MACHINERY

SINCLAIR

SINCLAIR REFINING COMPANY
630 FIFTH AVE. NEW YORK 20, N. Y.

With a stroke of his sword, Alexander the Great solves the riddle of the Gordian Knot.

With the stroke of your pen, YOU can solve the problem of lubrication by specifying NORGREN LUBRICATORS for all your air-actuated machine tools.

Air-borne oil fog created by NORGREN LUBRICATORS coats every internal part with a protective film of lubricant. Complete protection both when tool is running or idle.

NORGREN LUBRICATORS are fully adjustable to the Nth degree. Ful-view plastic bowl reminds machine operator when refilling is necessary.

For honest answers to your questions, consult our engineers at any time. C. A. Norgren Company, 222 Santa Fe Drive, Denver 2, Colorado.

★ FEATURE ATTRACTION IN THE FIELD OF LUBRICATION FOR 1949 ★

APRIL 11-12-13

4th ANNUAL CONVENTION
AND
2nd ANNUAL LUBRICATION EXHIBIT

A.S.L.E.

THE AMERICAN SOCIETY OF LUBRICATION ENGINEERS

HOTEL PENNSYLVANIA
NEW YORK, N. Y.

A THREE DAY PROGRAM OF INTEREST TO EVERYONE IN THE FIELD OF LUBRICATION

Two meeting rooms with concurrent sessions in which recognized authorities will cover technical and practical topics on lubricants and their application

---

THE LUBRICATION EXHIBIT
WILL DISPLAY THE COMPLETE CYCLE OF LUBRICATION FROM THE LABORATORY TO THE BEARING

The key manufacturers of lubricants, cutting fluids, laboratory equipment, application, handling and conveying devices will display their products

All Exhibits and Meeting Rooms on the Same Floor

For further information write

SECRETARY, A.S.L.E., 343 SO. DEARBORN STREET
CHICAGO 4, ILLINOIS

CURRENT LITERATURE

(*Continued from page* 266)

PERIPHERAL PHOTOGRAPHY OF PISTONS AND BEARINGS OF MOTORS
Groff, M.—pp. 50-52

Efficiency of lubrication of motors can be judged by the condition of those parts of pistons and bearings which are exposed to friction. The ordinary photography does not supply useful data due to the curvature of the cylindrical surfaces. The author describes the application of a peripheral photography which is free of this disadvantage and, in addition, permits stereoscopic representation in the case of an examination of deeper erosions.

Science Progress, Vol. XXXVI, No. 143, July 1948

THE SILICONES
Emeleus. H. J.—pp. 385-395

Organosilicon polymers are growing in importance. Production of intermediates and production of silicones are discussed. The first stage in the production of silicones is the hydrolysis of the alkyl or aryl silicon halide to the corresponding hydroxy derivative. The patent literature on this subject is confused. The silicones are used as damping fluids and hydraulic fluids, as lubricants for plastic moldings and other uses where resistance to heat, water and chemicals is needed. They are suitable for waterproofing ceramics. Silicone resins and silicone rubber are discussed. Silicone greases are intermediates between oils and resins. Paper may be coated with methyl silicone halides. Glass and ceramic surfaces may be treated.

SAE Quarterly Transactions, Vol. II, No. 2, April, 1948

FLEET TESTS OF SYNTHETIC LUBRICANTS (WITH DISCUSSION)
Wilson, D. K.—pp. 242-254

Results of extensive field tests of synthetic motor oil are reported here. The author suggests that the following advantages are possible with the use of synthetic oils as compared with detergent oils: 1. Ability to cover a greater range of temperatures with a single grade of oil. 2. Somewhat reduced carbon formation, particularly on valve stems; such carbon as is formed is of softer texture; some reduction in frequency of valve and carbon jobs; slightly freer rings. 3. It appears that oil change mileages can at least be doubled in any given class of service, with no increase in the rate of oil consumption and with improved engine cleanliness. The discussion takes up: use of synthetics for short-run delivery trucks, difficulties in evaluating data, extended-filter life with snythetics, synthetics for cleaner engines, LB-300 in severe service tests.

SAE Journal No. 2, February, 1948

EVALUATE LIGHT PLANE ENGINE OIL IN FLIGHT-SIMULATED LAB. TESTS
Backoff, W. J., William, N. D., Boldt, K., Hall, J. G., The Pure Oil Company.—p. 31

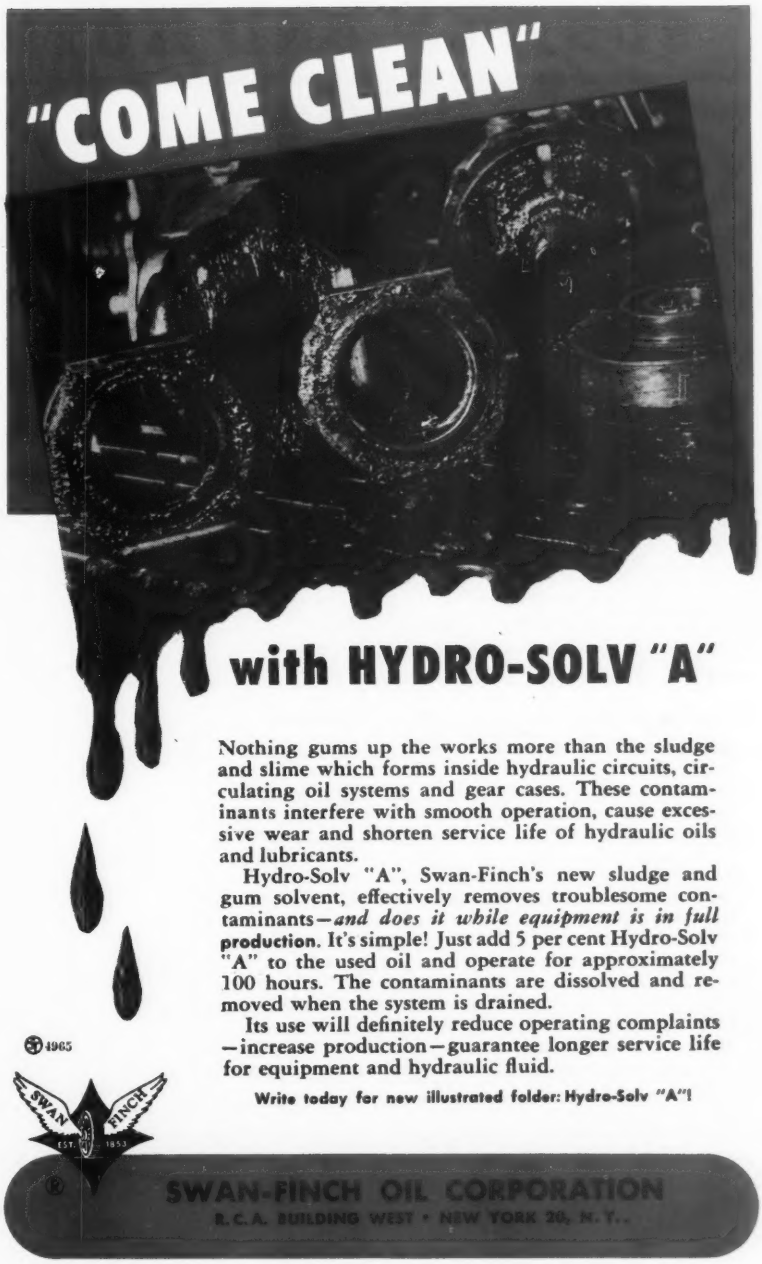
This article covers the theory that only by developing light aircraft engine lubricants in terms of actual performance of these engines will a satisfactory oil emerge.

DISCUSSERS DEBATE LIGHT-OIL PROPOSAL
Tongberg, Carl O., Standard Oil Development Co.—p. 45

Consensus of discussion.

PROPOSED LIGHT OIL SOLVES SUB-ZERO PROBLEMS
Upham, E. W. & Mougey, H. C., General Motors Corp.—p. 43

Winter tests in northern U. S. and Canada reveal that automobile instruction book recommendations for the lubricant to be used for temperatures below 10 deg. F. are unsatisfactory.


"COME CLEAN"
with HYDRO-SOLV "A"
Nothing gums up the works more than the sludge and slime which forms inside hydraulic circuits, circulating oil systems and gear cases. These contaminants interfere with smooth operation, cause excessive wear and shorten service life of hydraulic oils and lubricants.
Hydro-Solv "A", Swan-Finch's new sludge and gum solvent, effectively removes troublesome contaminants—and does it while equipment is in full production. It's simple! Just add 5 per cent Hydro-Solv "A" to the used oil and operate for approximately 100 hours. The contaminants are dissolved and removed when the system is drained.
Its use will definitely reduce operating complaints—increase production—guarantee longer service life for equipment and hydraulic fluid.
Write today for new illustrated folder: Hydro-Solv "A"!
4965
SWAN FINCH
EST. 1853
SWAN-FINCH OIL CORPORATION
R.C.A. BUILDING WEST • NEW YORK 20, N. Y.

The Technical Survey, Vol. IV, No. 25, June 19, 1948

PETROLEUM CHEMICALS
Anon.—p.367
(Chem. Trade J., May 28, 1948, p. 556)

Among the projects undertaken by the new Shell research center at Thornton, Eng., is the pilot plant development of compounds obtained by reacting olefins with maleic anhydride, these being used as rust preventives and lubricating additives, developed under the name "Ionex." Methyl heptyl carbonate is also being produced for perfumes, and considerable work is being done on production of naphthenic acids from petroleum residues. This research also includes wax cracking, production of water emulsion paints from petroleum products, and detergents.

CUTTING FLUID ACTION
Merchant—p. 372
(Machinery, June, 1948, p. 177)

Fundamentals of cutting fluid action.

Vol. IV, No. 26, June 26, 1948

HYDRAULIC FLUID
Anon.—p. 387
(Business Week, June 19, 1948, p. 70)

Socony-Vacuum's improved hydraulic fluid for torque converters is known as Mobilfluid 62.

SUBJECT AND AUTHOR INDEX

This index includes all material appearing in Volume 4 (February, April, June, August, October and December, 1948)

LUBRICATION ENGINEERING — *Names of authors are in small capitals*

A

	NO.	PAGE
A Look Inside the Mechanical Seal and Design Consideration, CARL E. SCHMITZ	1	14
Additives, Application of, to Lubricating Oils, DR. JAMES W. RAMSAY	2	63
Aerosols, Lubricating, K. C. MOSIER	5	217
ALEXANDROFF, WALTER A., Discussion of Schmidt, A. O. and Sirotkin, G.V.B., Article	6	265
Antifriction Bearing Developments, A. STEWART MURRAY	6	252
Application of Additives to Lubricating Oils, DR. JAMES W. RAMSAY	2	63

B

BASTIAN, E. L. H., Biography of	2	75
BASTIAN, E. L. H., Coolants for Metal Working	2	75
Bearing, Antifriction, Developments, A. STEWART MURRAY	6	252
Bearings, Diesel Engine, Heavy-Duty, Notes on, L. M. TICHVINSKY	4	170
Bearings, Journal, Oil Flows and Running Temperatures of Lightly Loaded, JOHN BOYD and B. P. ROBERTSON	2	58
Bearings, Sleeve, Hydrodynamic Lubrication of, Subjected to Varying Loads, JOHN T. BURWELL	2	67
BIKERMAN, J. J., Biography of	5	208
BIKERMAN, J. J., Mechanism of Friction and Lubrication, The	5	208
BOSTON, O. W., Discussion of Schmidt, A. O. and Sirotkin, G.V.B., Paper	6	265
BOYD, JOHN, and ROBERTSON, B. P., Oil Flows and Running Temperatures of Lightly Loaded Journal Bearings	2	58
BOYD, JOHN, Biography of	2	58
BURWELL, JOHN T., Hydrodynamic Lubrication of Sleeve Bearings Subjected to Varying Loads	2	67

C

Chemical Tests, The Significance of, To Consumers of Lubricants, WILLIAM EISMAN, JR.	6	257
Coolants for Metal Working, E. L. H. BASTIAN	2	75
Corrosion Inhibitors, Mechanism of Action of Bearing, in Crankcase Lubricants, J. D. GUTTENPLAN and C. F. PRUTTON	3	125
CURRIE, C. C., Biography of	5	221
CURRIE, C. C., Performance of Silicone Lubricants at High Temperatures	5	220
Cutting Fluids, and Power Requirements, Effects of, in Metal Cutting Operations, A. O. SCHMIDT and G. V. B. SIROTKIN	6	261
Cutting Fluids, The Evaluation of, in Laboratory Equipment, L. H. SUDHOLZ	1	18
Cutting Fluids, Water-Mixtures as Grinding and, WILLIAM H. OLDACRE	4	162

D

Design Consideration, and A Look Inside the Mechanical Seal, CARL E. SCHMITZ	1	14
Diesel Engine Bearings, Heavy-Duty, Notes on, L. M. TICHVINSKY	4	170

E

Education, Lubrication Engineering, DUDLEY D. FULLER	3	118
Effects of Cutting Fluids and Power Requirements in Metal Cutting Operations, A. O. SCHMIDT and G. V. B. SIROTKIN	6	261
EISMANN, WILLIAM, JR., Biography of	6	259
EISMANN, WILLIAM, JR., Significance of Chemical Tests to Consumers of Lubricants, The	6	257
Engine Lubrication, Improved, Through Used Oil Analysis, H. L. HEMMINGWAY	4	175
Engineering Education, Lubrication, DUDLEY D. FULLER	3	118
Evaluation of Cutting Fluids in Laboratory Equipment, The, L. H. SUDHOLZ	1	18
Evaluation of Motor Oils by the Underwood Oxidation Test, The, L. H. STRANAHAN	1	28

F

Fats and Oils for Grinding and Polishing, E. W. STEINITZ	2	81
Filtration of Insulating Oil Through Adsorbent Materials, E. M. KIPP	3	122
Friction and Lubrication, The Mechanism of, J. J. BIKERMAN	5	208
FULLER, DUDLEY D., Biography of	3	118
FULLER, DUDLEY D., Lubrication Engineering Education	3	118

G

Gear Drives, Lubrication of Industrial, F. RICHARDZ	1	25
Grinding and Cutting Fluids, Water-Mixtures as, WILLIAM H. OLDACRE	4	162
Grinding and Polishing, Fats and Oils for, E. W. STEINITZ	2	81
GUTTENPLAN, J. D., Biography of	3	125
GUTTENPLAN, J. D., and PRUTTON, C. F., Mechanism of Action of Bearing Corrosion Inhibitors in Crankcase Lubricants	3	125

H

HAGG, A. C., Biography of	4	166
HAGG, A. C., Vibration Aspects of Lubrication, Some	4	166
HEMMINGWAY, H. L., Biography of	4	176
HEMMINGWAY, H. L., Improved Engine Lubrication Through Used Oil Analysis	4	175
Hydrodynamic Lubrication of Sleeve Bearings Subjected to Varying Loads, JOHN T. BURWELL	2	67

I

Improved Engine Lubrication Through Used Oil Analysis, H. L. HEMMINGWAY	4	175
Industrial Gear Drives, Lubrication of, F. RICHARDZ	1	25
Inhibitors, Mechanism of Action of Bearing Corrosion, in Crankcase Lubrication, J. D. GUTTENPLAN and C. F. PRUTTON	3	125

K

KIPP, E. M., Biography of	3	122
KIPP, E. M., Filtration of Insulating Oil Through Adsorbent Materials	3	122

L

Laboratory Equipment, The Evaluation of Cutting Fluids in, L. H. SUDHOLZ	1	18
LOANE, C. M., Discussion of Guttenplan, J. D. and PRUTTON, C. F., Article	3	131
Lubricants, Crankcase, Mechanism of Action of Bearing Corrosion Inhibitors in, J. D. GUTTENPLAN and C. F. PRUTTON	3	125
Lubricants, Silicone, Performance of, at High Temperatures, C. C. CURRIE	5	220
Lubricants, The Significance of Chemical Tests To Consumers of, WILLIAM EISMANN, JR.	6	257
Lubricating Aerosols, K. C. MOSIER	5	217
Lubricating Oils, Application of Additives to, DR. JAMES W. RAMSAY	2	63
Lubrication Engineering Education, DUDLEY D. FULLER	3	118
Lubrication, Hydrodynamic, of Sleeve Bearings Subjected to Varying Loads, JOHN T. BURWELL	2	67
Lubrication, Improved Engine, Through Used Oil Analysis, H. L. HEMMINGWAY	4	175
Lubrication of Industrial Gear Drives, F. RICHARDZ	1	25
Lubrication, Some Vibration Aspects of, A. C. HAGG	4	166
Lubrication, The Mechanism of Friction and, J. J. BIKERMAN	5	208

M

Mechanism of Action of Bearing Corrosion Inhibitors in Crankcase Lubricants, J. D. GUTTENPLAN and C. F. PRUTTON	3	125
Mechanism of Friction and Lubrication, The, J. J. BIKERMAN	5	208
Metal Working, Coolants for, E. L. H. BASTIAN	2	75
MORGAN, FRANK, Discussion of Bikerman, J. J., Article	5	215
MOSIER, K. C., Biography of	5	217
MOSIER, K. C., Lubricating Aerosols	5	217
MURRAY, A. STEWART, Antifriction Bearing Developments	6	252
MURRAY, A. STEWART, Biography of	6	252

N

NEEDS, S. J., Discussion of Bikerman, J. J., Article	5	214
Notes on Heavy-Duty Diesel Engine Bearings, L. M. TICHVINSKY	4	170

O

Oil Flows and Running Temperatures of Lightly Loaded Journal Bearings, JOHN BOYD and B. P. ROBERTSON	2	58
Oil, Insulating, Filtration of, Through Adsorbent Materials, E. M. KIPP	3	122
Oil, Used, Analysis, Improved Engine Lubrication Through, H. L. HEMMINGWAY	4	175
Oils and Fats for Grinding and Polishing, E. W. STEINITZ	2	81
Oils, Lubricating, Application of Additives to, DR. JAMES W. RAMSAY	2	63
Oils, Motor, The Evaluation of, by the Underwood Oxidation Test, L. H. STRANAHAN	1	28
OLDACRE, WILLIAM H., Biography of	4	163
OLDACRE, WILLIAM H., Water-Mixtures as Grinding and Cutting Fluids	4	162
Oxidation, Underwood Test, The Evaluation of Motor Oils by the, L. H. STRANAHAN	1	28

P

Performance of Silicone Lubricants at High Temperatures, C. C. CURRIE	5	220
Power Requirements and Cutting Fluids, Effects of, In Metal Cutting Operations, A. O. SCHMIDT and G. V. B. SIROTKIN	6	261
PRUTTON, C. F., Biography of	3	125
PRUTTON, C. F., ——— See Guttenplan, J. D.	3	125

R

	NO.	PAGE
RAMSAY, DR. JAMES W., Application of Additives to Lubricating Oils	2	63
RAMSAY, DR. JAMES W., Biography of	2	63
RICHARDZ, F., Lubrication of Industrial Gear Drives	1	25
ROBERTSON, B. P., Biography of	2	58
ROBERTSON, B. P., ——— See Boyd, John	2	58
ROESS, L. C., Discussion of Bikerman, J. J., Article	5	215
ROUNDS, T. E., Discussion of Murray, A. Stewart, Article	6	256

S

SCHMIDT, A. O., Biography of	6	262
SCHMIDT, A. O., and SIROTKIN, G. V. B., Effects of Cutting Fluids and Power Requirements in Metal Cutting Operations	6	261
SCHMITZ, CARL E., A Look Inside the Mechanical Seal and Design Consideration	1	14
SCHMITZ, CARL E., Biography of	1	14
Seals, Mechanical, A Look Inside the, and Design Consideration, CARL E. SCHMITZ	1	14
Significance of Chemical Tests to Consumers of Lubricants, The, WILLIAM EISMANN, JR.	6	257
Silicone Lubricants, Performance of, at High Temperatures, C. C. CURRIE	5	220
SIROTKIN, G. V. B., Biography of	6	262
SIROTKIN, G. V. B. ——— See Schmidt, A. O.	6	261
STEINITZ, E. W., Biography of	2	81
STEINITZ, E. W., Fats and Oils for Grinding and Polishing	2	81
STRANAHAN, L. H., Evaluation of Motor Oils by the Underwood Oxidation Test, The, L. H. STRANAHAN	1	28
SUDHOLZ, L. H., Evaluation of Cutting Fluids in Laboratory Equipment, The	1	18

T

Temperatures, High, Performance of Silicone Lubricants at, C. C. CURRIE	5	220
Temperatures, Running, and Oil Flows of Lightly Loaded Journal Bearings, JOHN BOYD and B. P. ROBERTSON	2	58
TICHVINSKY, L. M., Biography of	4	170
TICHVINSKY, L. M., Notes on Heavy-Duty Diesel Engine Bearings	4	170
Test, Underwood Oxidation, The Evaluation of Motor Oils by the, L. H. STRANAHAN	1	28
Tests, Chemical, The Significance of, To Consumers of Lubricants, WILLIAM EISMANN, JR.	6	257

U

Underwood Oxidation Test, The Evaluation of Motor Oils by the, L. H. STRANAHAN	1	28

V

Vibration Aspects of Lubrication, Some, A. C. HAGG	4	166

W

Water-Mixtures as Grinding and Cutting Fluids, WILLIAM H. OLDACRE	4	162

INDUSTRIAL MEMBERSHIP*

ALUMINUM CO. OF AMERICA
New Kensington, Pennsylvania
Dr. E. M. Kipp

AMERICAN STEEL FOUNDRIES
410 North Michigan Avenue
Chicago 1, Illinois
Mr. R. D. Brizzolara

BENDIX PRODUCTS DIVISION
BENDIX AVIATION CORP.
South Bend 20, Indiana
Mr. D. M. Cleaveland

CARNEGIE-ILLINOIS STEEL CORP.
Carnegie Building
Pittsburgh 30, Pennsylvania
No representative appointed

THE CINCINNATI MILLING MACH. CO.
CIMCOOL DIVISION
Cincinnati 9, Ohio
Dr. M. E. Merchant

CROWN CORK & SEAL CO., INC.
Baltimore 24, Maryland
Mr. Harry Rau, Jr.

DOW CHEMICAL CO.
Midland, Michigan
Mr. E. F. Graves

FARVAL CORP.
3249 E. 80th Street
Cleveland 4, Ohio
Mr. A. J. Jennings

GITS BROTHERS MANUFACTURING CO.
1846 S. Kilbourn Avenue
Chicago 23, Illinois
Mr. Frank Kovarik

HODSON CORP.
5301-11 West 66th Street
Chicago 38, Illinois
Mr. W. H. Hodson

HONAN-CRANE CORPORATION
409 Indianapolis Avenue
Lebanon, Indiana
Mr. F. G. Fisher

E. F. HOUGHTON AND COMPANY
303 West Lehigh Avenue
Philadelphia 33, Pennsylvania
Mr. Frank Ross

INLAND STEEL CO.
38 South Dearborn Street
Chicago 3, Illinois
Mr. D. N. Evans

L. R. KERNS CO.
2657 E. 95th Street
Chicago, Illinois
Mr. L. R. Kerns

LINCOLN ENGINEERING CO.
5701 Natural Bridge Avenue
St. Louis, Missouri
Mr. A. P. Fox

LUBRI-ZOL CORP.
Box 3057 Euclid Station
Cleveland 17, Ohio
Mr. Arthur O. Willey

NATIONAL CASH REGISTER CO.
Dayton 9, Ohio
Mr. R. F. McKibben

PRECISION SCIENTIFIC COMPANY
3737 W. Courtland Street
Chicago, Illinois
Mr. J. P. Duray

REPUBLIC STEEL CORP.
Republic Building
Cleveland, Ohio
Mr. C. E. Pritchard

SHELL OIL CO., INC.
50 W. 50th St.
New York, New York
Mr. B. G. Symon

SINCLAIR REFINING COMPANY
630—Fifth Avenue
New York 20, New York
Mr. C. M. Larson

SOCONY-VACUUM OIL CO., INC.
26 Broadway
New York 4, New York
Mr. John F. Fast

STANDARD OIL CO. OF CALIFORNIA
Standard Oil Building
San Francisco 20, California
Mr. J. C. Smith

STANDARD OIL OF INDIANA
910 South Michigan Avenue
Chicago 80, Illinois
Mr. G. T. Dougherty

STEWART-WARNER CORP.
1826 Diversey Parkway
Chicago, Illinois
Mr. G. Treffeisen

SUN OIL CO.
1608 Walnut Street
Philadelphia 3, Pennsylvania
Dr. E. S. Ross

SWAN-FINCH OIL CORP.
201 N. Wells St.
Chicago 6, Illinois
Mr. Sam W. Bodman

TEXAS COMPANY
135 East 42nd Street
New York 17, New York
Mr. F. C. Kerns

TIMKEN ROLLER BEARING COMPANY
1835 Dueber Avenue, S. W.
Canton 6, Ohio
Mr. H. T. Peeples

TRABON ENGINEERING CORP.
1814 East 40th Street
Cleveland 3, Ohio
Mr. Wilbur Deutsch

WESTINGHOUSE ELECTRIC CORP.
Research Laboratory
East Pittsburgh, Pennsylvania
Dr. H. E. Mahncke

**In accordance with the American Society of Lubrication Engineers Constitution each industrial member company names one man as its official representative. The names of men thus appointed are indicated in italics.*

Members of the American Society of Lubrication Engineers*

(As of November 5, 1948)

ACKERMAN, A. W.
Anderson Oil Co.
Portland, Connecticut

ADAMS, J. Q.
E. F. Houghton & Co.
7 E. Grand Avenue
Detroit 3, Michigan

ADAMS, PHIL S.
General Petroleum Corp. of Cal.
108 W. 2nd Street
Los Angeles 12, California

ADAMS, ROBERT E.
Battelle Memorial Institute
505 King Avenue
Columbus 1, Ohio

ADAMSON, ROBERT W.
Union Oil Co. of Calif.
Oleum, California

ADLEY, JOSEPH A.
Standard Oil Co.
20 No. Wacker Drive
Chicago, Illinois

AHLBERG, CLARENCE R.
Sun Oil Co.
20 Providence Street
Boston 16, Massachusetts

ALBL, OSWALD M.
Thompson Aircraft Prod. Co.
23555 Euclid Avenue
Euclid, Ohio

ALBRIGHT, W. W.
Shell Oil Co., Inc.
624 South Michigan Avenue
Chicago, Illinois

ALDRIDGE, FRANK M.
The J. W. Kelley Co.
3401 W. 140th Street
Cleveland 11, Ohio

ALEXANDROFF, WALTER A.
Pate Oil Co.
3460 W. Leeds Pl.
Milwaukee, Wisconsin

ALLEN, H. W.
Alemite Sales Co.
53-59 E. 25th St.
Chicago 16, Illinois

ALLISON, J. E.
E. F. Houghton Co.
606 W. Wisconsin Avenue
Milwaukee 3, Wisconsin

ALTMAN, ROBERT W.
U. S. Government
Bldg. 32, Wright Field
Dayton, Ohio

ANDERSON, DAVID R.
Superior Steel Corp.
Superior Street
Carnegie, Pennsylvania

APPELBY, DONALD C.
Shell Oil Co., Inc.
290 Larkin Street
Buffalo, New York

APPLETON, WILLIAM
Sun Oil Co.
4847 Woodward Ave.
Detroit, Michigan

ARCHER, W. L.
Caltex (Philippines), Inc.
91 Plaza Moraga
Manila, Philippines

AREND, RICHARD S.
DeLaval Separator Co.
447—4th Ave.
Pittsburgh 19, Pennsylvania

ARMFELT, OSCAR W.
Canfield Oil Co.
285 Tonnele Ave.
Jersey City 6, New Jersey

ARMSTRONG, ROY
Bowser, Inc.
528 White Building
Buffalo 2, New York

ARNOLD, KARL A.
National Tube Company
Ellwood City, Pennsylvania

ASHBY, WILLIAM L.
Mohawk Refining Co.
472 Frelinghuysen Ave.
Newark, N. J.

ASHCRAFT, LOYAL E.
The Brooks Oil Company
6432 Cass Avenue
Detroit, Michigan

ASHMAN, Carleton W.
Shell Oil Company, Inc.
Bush St.,
San Francisco, Calif.

ASKEW, MILES A.
The Texas Co.
13308 6th Avenue
Cleveland 12, Ohio

ATWATER, K. W.
K. W. Atwater Engineering Co.
1103 Investment Building
Pittsburgh 22, Pennsylvania

AVEY, J. R.
Avey Products Company
P. O. Box 1914
Tulsa, Oklahoma

AYCOCK, NATHANIEL M.
The Texas Co.
135 East 42nd Street
New York, New York

BACHMANN, BERNARD
Ekco Products Co.
1949 N. Cicero Ave.
Chicago 39, Illinois

BAILEY, EARLE D.
St. Regis Paper Co.
Bucksport, Maine

BALLARD, H. E.
Elco Chemical Co.
700 Delaware Street
P. O. Box 298
Berkeley, California

BALLARD, LEE
Tide Water Associated Oil Co.
17 Battery Place
New York 4, New York

BANNATYNE, R. J.
Atlantic Refining Co.
1100 Chamber of Commerce Bldg.
Pittsburgh, Pennsylvania

BARCLAY, JOHN R.
The Ironsides Co.
270 West Mound Street
Columbus 16, Ohio

BARDSLEY, JOSEPH F.
Standard Oil Co. of N. J.
500 N. Broad St.
Elizabeth, N. J.

BARKER, MAYNARD P.
General Petroleum Corp. of Cal.
2725 East 37th Street
Los Angeles, California

BARKOW, MILTON F.
Barkow Petroleum Company
P. O. Box 335
Pt. Richmond Station
Richmond, California

BARNARD, NORRIS C.
Colonial Beacon Oil Co.
50 Rockefeller Plaza
New York City 20, New York

BARLEY, SAMUEL B.
Esso Standard Oil Co.
50 Rockefeller Plaza
New York 20, New York

BARNES, T. C.
Socony Vacuum Oil Co., Inc.
530 Hanna Bldg.
Cleveland 15, Ohio

BARROW, RICHARD S.
Shell Oil Co., Inc.
1008 W. 6th St.
Los Angeles 14, Calif.

BARTELS, ROLAND O.
Socony-Vacuum Oil Co., Inc.
907 South First St.
Milwaukee, Wisconsin

BARTH, EDWIN J.
A. Johnson & Co., Refinery
Oljeraffinaderiet
Nynashamn, Sweden

BARTON, V. J.
Aro Equipment Corp.
Bryan, Ohio

BARTON, WARREN H.
Alemite Corporation of N. Y.
37 West 65th St.
New York 23, N. Y.

BARWORTH, WILLIAM
Pennzoil Company
942 South Hope Street
Los Angeles, California

BASORE, JOHN W.
Mid-Continent Petroleum Corp.
Mid-Continent Building
Tulsa Oklahoma

BASSETT, F. H.
Socony Vacuum Oil Co., Inc.
17 West Market Street
Indianapolis, Indiana

BATH, THOMAS N.
Shell Oil Co., Inc.
50 West 50th Street
New York, New York

BATTENFELD, C. F.
C. F. Battenfeld Oil Co.
1340 Oakman Blvd.
Detroit 6, Michigan

BAYSTER, N. G.
American Oil Co.
Grant Bldg.
Pittsburgh 30, Pennsylvania

BEACH, JOHN
Allube Corp.
928 Allen Avenue
Glendale 1, California

BEAIRD, P. M.
Arkansas Fuel Oil Co.
3419—5th Avenue N.
Birmingham 1, Alabama

BEALL, ALMON L.
Wright Aeronautical Corp.
132 Beckwith Avenue
Paterson 3, New Jersey

BEATTY, JOHN L.
L. R. & J. L. Beatty
2005-13 W. Bellevue Street
Philadelphia 40, Pennsylvania

BEAVER, BASIL A.
Gray Company, Inc.
60—11th Avenue, N. E.
Minneapolis, Minnesota

BECHTEL, DAVID S.
Sun Oil Co.
1608 Walnut Street
Philadelphia, Pennsylvania

BECK, CLARENCE J.
Globe Steel Tubes Co.
3839 W. Burnham Street
Milwaukee, Wisconsin

BECKER, CARL D.
The Linde Air Products Co.
Woodward and E. Park Drive
Tonawanda, New York

BECKER, GEORGE
E. F. Houghton & Co.
70 Hudson Street
Jersey City, N. J.

BEERS, A. DODSON, JR.
Carnegie-Illinois Steel Corp.
Gary Steel Works
Gary, Indiana

BEGGS, WATSON G.
Stewart-Warner Corp.
601 Turk Street
San Francisco 2, California

BELFIT, ROBERT W.
Scovill Mfg. Co.
99 Mill Street
Waterbury 91, Connecticut

BELL, WILLIAM W.
Celanese Chemical Corp.
180 Madison Ave.
New York City, N. Y.

BENJAMIN, I. N.
Socony Vacuum Oil Co.
606 Vandalia Ave.
St. Paul, Minn.

BENNER, DONALD W.
Lincoln Engineering Co.
8627 Woodward Avenue
Detroit, Michigan

BENNETT, ELLIOTT W. M.
Coolant Clarifier Co.
5837 S. Ashland Ave.
Chicago, Illinois

BENNETT, KENNETH A.
J. G. White Engineering Corp.
Las Piedras,
Estado Falcon
Venezuela

BERGAN, WILLIAM A.
Calumet Refining Co.
4917 Kingsley Drive
Indianapolis, Indiana

BERGMAN, H. E.
Bowser, Inc.
110 N. Franklin Street
Chicago, Illinois

BIELING, HOWARD J.
Johns-Manville Corp.
22 East 40th Street
New York 16, New York

BIERLEIN, CARL A.
Cleveland Diesel Engine Div.
General Motors Corporation
2160 W. 106th Street
Cleveland 11, Ohio

BIGELOW, MERRITT A., JR.
Carbide & Carbon Chemicals Corp.
230 North Michigan Avenue
Chicago 1, Illinois

BIGGER, I. S.
Socony Vacuum Oil Co.
4140 Lindell Street
St. Louis, Missouri

BINGHAM, THOMAS E.
Imperial Oil Limited
150 Laird Drive
Leaside, Ontario, Canada

BINNS, H. M. STANLEY
Cincinnati Milling Machine Co.
Marburg Avenue
Cincinnati 9, Ohio

BINZ, ANTHONY D.
Jones & Laughlin Steel Corp.
3516 Second Avenue
Pittsburgh 30, Pennsylvania

BISCHOFF, J. WILEY
The Texas Co.
332 S. Michigan Ave.
Chicago 4, Illinois

BISHOP, JOHN W.
Tide Water Associated Oil Co.
East 22nd Street
Bayonne, N. J.

BLACK, ALEXANDER R.
Shell Oil Co., Inc.
50 W. 50th Street
New York 20, N. Y.

BLACK, PAUL H.
Cornell University
Ithaca, New York

BLACKER, BERNARD
New Britain Mach. Co.
South
New Britain, Connecticut

BLACKSHERE, FRED B.
Standard Oil Co. of Indiana
715 East 10th Street
Wichita, Kansas

BLAND, JONATHAN F.
Sun Oil Co.
Box 1270
Wheeling, W. Va.

BLOK, HARMEN
N. V. DeBattaafsche Petroleum
Mij. (Royal Dutch Shell)
20 Broekmolenweg
Delft, Holland

BLOOMENTHAL, DR. SIDNEY
Automatic Electric Co.
1033 West Van Buren St.
Chicago, Ill.

BLURTON, M. R.
Alemite Co. of So. Calif.
333 West Washington Street
Los Angeles, California

BOAL, JOHN F.
Carnegie-Ill. Steel Corp.
Munhall, Pennsylvania

BOARD, H. L.
Swan-Finch Oil Corp.
R.C.A. Building, West
New York 20, New York

BOBBISH, GEORGE
Warren Refining & Chemical Co.
Detroit 16, Michigan

BOBBISH, MICHAEL
Warren Refining & Chemical Co.
308 Euclid Avenue
Cleveland, Ohio

BODA, VERN C.
The Franklin Oil & Gas Co.
Bedford, Ohio

BODMAN, SAM W.
Swan Finch Oil Co.
RCA Building West
New York 20, New York

BOEHL, HENRY, JR.
American Radiator & Standard
Sanitary Corp.
1541 South 7th Street
Louisville, Kentucky

*Company affiliations and addresses only are given—addresses not necessarily preferred mailing addresses.

BOIE, ALVIN E.
Allis Chalmers Mfg. Co.
West Allis 14, Wisconsin

BOLLINGER, PARK G.
Federated Metals Div.
615 Gross Street
Pittsburgh 24, Pennsylvania

BOLLMAN, MICHAEL J.
Gulf Oil Corp.
Gross Street & P.R.R.
Pittsburgh 6, Pennsylvania

BONADIO, E. P.
Aluminum Co. of America
Cressona Sch. Co.
Pennsylvania

BOORD, HARRY W.
American Oil Co.
1301 Grant Building
Pittsburgh, Pennsylvania

BOOZ, HOWARD E.
The Texas Co.
P. O. Box 327
Marcus Hook, Pa.

BORAH, KENNETH
Shell Oil Co., Inc.
Wood River, Ill.

BORDEN, LLOYD K.
Borden Oil Co.
1715 Cambridge Avenue
Sheboygan, Wisconsin

BOSTON, WILBUR J.
Valvoline Oil Co.
1900 East Warren
Detroit, Michigan

BOSWINKLE, GEORGE
Michiana Prod. Corp.
Box 302
Michigan City, Indiana

BOURNE, JOHN P.
Standard Oil Co. (California)
225 Bush Street
San Francisco 20, California

BOWDEN, WILLIAM
Firestone Tire & Rubber Co.
1200 Firestone Parkway
Akron, Ohio

BOWERS, D E.
General Petroleum Corp.
2721 E. 37th Street
Los Angeles, California

BOWERS, GEORGE F.
Standard Oil Co. (Ind.)
910 S. Michigan Avenue
Chicago 80, Illinois

BOWMAN, WILLIAM K.
Union Oil Co. of Calif.
P. O. Box 751
Pasadena, Calif.

BOYCE, JOHN
Food Machinery Corp., A B Div.
333 West Julian
San Jose, California

BOYD, JOHN
Westinghouse Electric Corp
Research Lab.—Ardmore Blvd.
East Pittsburgh, Pennsylvania

BRACE, R. LYLE
Brace Engineering Co.
440 E. Schantz Avenue
Dayton 9, Ohio

BRACKEN, JOSEPH KERR
Sinclair Refining Co.
10 W. 51st Street
New York 20, New York

BRADLEY, JOHN C
American Brass Co.
Waterbury 88, Conn.

BRADY, JAMES A.
Penola, Inc.
P. O. Box 67
River Rouge Station
Detroit 18, Michigan

BRAMMAN, WALTER H.
Shell Oil Co.
5801 York Road
Baltimore, Maryland

BRAND, EDGAR E.
L. Sonneborn Sons, Inc.
400 West Madison Street
Chicago 28, Illinois

BRANDT, JOSEPH A.
168 Round Hill Road
Hamden 14, Connecticut

BRENHOLTS, GEORGE W.
N. Y. and N. J. Lubricant Co.
2328 Lamberton Road
Cleveland Heights 18, Ohio

BRENNAN, ELMER W.
The Pure Oil Co.
Box 266
Winnetka, Illinois

BRENNAN, THOMAS L.
Gulf Oil Corp.
17 Battery Place
New York 4, N. Y.

BREWER, ALLEN F.
The Texas Co.
135 E. 42nd Street
New York, New York

BREWER, ARTHUR G.
Sun Oil Co.
Marcus Hook, Pennsylvania

BREZA, GEORGE
Mackintosh-Hemphill Co.
901 Bingham Street
Pittsburgh 3, Pennsylvania

BRIGGMANN, GEORGE F.
Carbide & Carbon Chemical Corp.
30 East 42nd Street
New York, New York

BRIGHT, JOHN G.
Socony Vacuum Oil Co., Inc.
P. O. Box 191
McKees Rocks, Pa.

BRIGHT, ROBERT E.
Dow Corning Corp.
Empire State Building
New York City, New York

BRIGHTON, LOREN E.
Bethlehem Steel Co.
Johnstown, Pennsylvania

BRINKERHOFF, JAMES L.
EPCO Eastern Petroleum Co.
117 Henshaw Avenue
Springfield, New Jersey

BRISTOL, OSCAR L.
Chrysler Corp.
341 Massachusetts Ave.
Detroit, Michigan

BRIZZOLARA, RALPH D.
American Steel Foundries
410 North Michigan Avenue
Chicago 11, Illinois

BROOKS, W. M.
Allis Chalmers Supercharger Co.
Milwaukee 14, Wisconsin

BROWN, ALLEN A.
Reilly-Whiteman Walton Co.
Conshohocken, Pennsylvania

BROWN, ELTON S.
Standard Oil Co. (N. J.)
P. O. Box 713
Charleston 23, W. Va.

BROWN, HAROLD F.
The Ohio Oil Co.
539 South Main Street
Findlay, Ohio

BROWNELL, AUBREY
Bethlehem Steel Co.
Lackawanna, N. Y.

BRUNDIGE, GEORGE M.
American Machine & Foundry Co.
5502—2nd Avenue
Brooklyn 20, N. Y.

BRUNS, WARREN H.
Cleveland Graphite Bronze Co.
17000 St. Clair Avenue
Cleveland 10, Ohio

BRUTON, HAROLD B.
R. W. Horsey, Ltd.
284 St. Helens Avenue
Toronto, Ontario, Canada

BRYANT, CLARE P.
Cadillac Oil Co.
7180 East McNichols Road
Detroit 12, Michigan

BRYANT, M. W.
Shell Oil Company, Inc.
1133 S. Marengo St.
Pasadena, California

BRYANT, WILLIAM C.
Swan Finch Oil Corp.
RCA Building, West
New York 20, New York

BUBNICK, CHAS. J.
Caterpillar Tractor Co.
Peoria, Ill.

BUCHANAN, J. E.
The Texas Co.
P. O. Box 1532
1403 Munsey Building
Baltimore 2, Maryland

BUCKERIDGE, W. I.
Standard Oil Co., Inc.
20 No. Wacker Drive
Chicago 80, Illinois

BUCKNER, FRANKLIN
Alemite Co.
419 North Capitol Street
Indianapolis, Indiana

BUDERUS, W. H.
Sinclair Refining Co.
630 Fifth Avenue
New York 20, New York

BUKOVICH, WILLIAM L.
Socony-Vacuum Oil Co., Inc.
901 South First Street
Milwaukee, Wisconsin

BULLARD, ROBINSON D.
Bullard Co.
286 Canfield Avenue
Bridgeport 2, Connecticut

BULLIONS, CORNELIUS S.
Socony-Vacuum Oil Co., Inc.
Robb Street and Ohio River
McKees Rocks, Pennsylvania

BUNDY, PAUL E.
Salisbury Axle Co.
Fort Wayne, Indiana

BURKE, WILLIAM J.
The Texas Co.
332 So. Michigan Avenue
Chicago 4, Illinois

BURNS, JOHN E.
Burns Laboratories, Inc.
514 W. Wyoming Street
Indianapolis 2, Indiana

BURNS, JOHN E., JR.
Crescent Oil Co.
514 W. Wyoming Street
Indianapolis 2, Indiana

BURT, LOUIS B.
Lincoln Engineering Co.
2415 S. Michigan Avenue
Chicago 16, Illinois

BUSSARD, RICHARD D.
Ladish Co.
5481 South Packard
Cudahy, Wisconsin

BUTLER, JOHN MANN
Monsanto Chemical Co.
Nicholas Road
Dayton 7, Ohio

BYRD, ROBERT N.
Hewitt Oil Co.
Meeting Street Road
P. O. Box 372
Charleston, South Carolina

CAIRNS, G. A.
Macco Products Co.
525 West 76th Street
Chicago 20, Illinois

CALLAGHAN, ANDY
Magie Bros., Inc. (Lubrication)
1640 Carroll Avenue
Chicago 12, Illinois

CALVERLEY, H. R.
Shell Oil Co., Inc.
900 United Bank Bldg.
W. 25th St. & Lorain
Cleveland 1, Ohio

CAMERON, WILLIAM H.
Chrysler Corporation
341 Massachusetts
Highland Park 3, Michigan

CAMPBELL, W. E.
Bell Telephone Laboratories
Murray Hill, N. J.

CAPSTRAN, RICHARD E.
Lincoln Equipment Co.
1618 W. Wells Street
Milwaukee, Wisconsin

CARLIN, AUSTIN E.
Lake Shore Oil Co.
5331 West 65th Street
Chicago, Illinois

CARLIN, WILLIAM
Pennzoil Co.
Chamber of Commerce Bldg.
Pittsburgh, Pennsylvania

CARMICHAEL, E. S.
Socony-Vacuum Oil Co., Inc.
412 Greenpoint Avenue
Brooklyn 22, New York

CARNES, W. R.
W. R. Carnes Co.
2066 Helena Street
Madison 4, Wisconsin

CARNEY, GEORGE F.
Gulf Refining Co.
P. O. Box A—S. Side Sta.
Youngstown, Ohio

CARPENTER, AARON E., MAJ.
E. F. Houghton & Co.
303 W. Lehigh Avenue
Philadelphia 23, Pennsylvania

CARPENTER, HARRY B
Extreme Pressure Oil Corp.
P. O. Box 404
Indianapolis 6, Indiana

CARR, EDWIN B.
Socony-Vacuum Oil Co.
59 E. Van Buren St.
Chicago 5, Illinois

CARR, WILLIAM H.
American Oil Co.
1200 4th Street, S.W.
Washington 4, D. C.

CARTER, LINDSAY P.
Production Supply Company
1927 Granville Street
Vancouver, British Columbia

CASSIDY, R. G.
Filmite Oil Corp.
Station K
Milwaukee 10, Wisconsin

CHALMER, STANLEY OSRIC
Commonwealth Oil Refineries, Ltd
90 William Street
Melbourne, C1, Australia

CHALMERS, F. E.
Socony-Vacuum Oil Co., Inc.
130 Pearl Street
Buffalo, N. Y.

CHAPIN, NOEL
Cities Service Oil Co.
927 1st National Bank Bldg.
Springfield, Ohio

CHAPMAN, ELLIOT W.
Colonial Beacon Oil Co.
P. O. Box 63, Station B
Buffalo, New York

CHAPPELL, PAUL F.
American Oil Co.
American Building
Baltimore 3, Md.

CHAPPELLE, C. V.
Sinclair Refining Company
2540 W. Cermak Road
Chicago 8, Illinois

CHATFIELD, MELVIN M.
D. A. Stuart Oil Co.
2727 S. Troy Street
Chicago, Illinois

CHERMAK, Robert C.
International Business Machines
North Street
Endicott, N. Y.

CHRISMAN, ROBERT R.
American Oil Company
Grant Building
Pittsburgh, Pennsylvania

CHRISTIAN, C. W.
General Petroleum Corp.
108 West 2nd Street
Los Angeles 12, California

CHURCHILL, LEONARD R.
Tide Water Associated Oil Co.
East 22nd St.
Bayonne, N. J.

CICHELLI, ANDREW E.
Bethlehem Steel Co.
Sparrows Point 19, Md.

CLARK, WILLIAM G.
The Pure Oil Co.
35 E. Wacker Drive
Chicago 1, Ill.

CLARK, WILSON J.
C. H. Clark Oil Co.
2625 E. 70th St.
Cleveland 4, Ohio

CLARKE, ARTHUR F.
Esso Standard Oil Co.
15 Page Blvd.
Springfield, Massachusetts

CLEARWATER, D. D.
Socony-Vacuum Oil Co., Inc.
17 W. Market Street
Indianapolis 9, Indiana

CLEAVELAND, DEAN M.
Bendix Prod. Div.
Bendix Aviation Corp.
South Bend 20, Indiana

CLOWER, JAMES I.
University of Delaware
Evans Hall
Newark, Delaware

COCANOUGHER, CLAUDE M.
Sinclair Refining Co.
1761 Waterman Avenue
Detroit, Michigan

CODDING, E. HALE
Tide Water Associated Oil Co.
17 Battery Place
New York City, New York

CODY, EDWARD H.
Richfield Oil Corp.
333 Montgomery Street
San Francisco, California

COKINDA, ROBERT M.
Shell Oil Co., Inc.
909 E. 22nd Street
Baltimore 18, Maryland

COLE, J. M.
Halowax Prod.
Div. of Union Carbide & Carbon Corp.
30 East 42nd St.
New York 17, N. Y.

COLEMAN, JOHN H.
Monsanto Chemical Co.
1700 S. 2nd Street
St. Louis, Missouri

COLLIER, ALBERT H.
Colt-Worthington Oil Work, Inc.
Commercial Avenue
Garden City, L. I., N. Y.

COLTON, JOSEPH G.
Fiske Bros. Refining Co.
129 Lockwood Street
Newark 5, New Jersey

CONNELL, KENNETH T.
Shell Oil Company, Inc.
1008 West 6th Street
Los Angeles, California

CONOVER, HUGH B.
Carnegie Illinois Steel Corp.
434 Fifth Avenue
Pittsburgh, Pennsylvania

COOPER, FRANK L.
Alvord Oil Co.
1501 S. Senate
Indianapolis 2, Indiana

COOPER, Howard
Sinclair Refining Company
630 Fifth Avenue
New York 20, N. Y.

COOPER, P. J.
Standard Oil Company of Calif.
533 Jergins Trust Building
Long Beach 2, California

COREY, THOMAS L.
Aluminum Co. of Amer.
New Kensington, Pennsylvania

COSTA, FENELON
Standard Oil Co. of Brazil
Caixa P. O. Box 970
Avenida Presidente Wilson 118
Rio de Janeiro, Brazil
South America

COUCH, RALPH L.
Central Petroleum Company
548 Standard Building
Cleveland 13, Ohio

COURTRIGHT, JAMES M.
Shell Oil Co. of Brit. Col., Ltd.
Stock Exchange Building
Vancouver, British Columbia

COWAN, A. M.
Shell Oil Co.
2219 W. Michigan
Indianapolis, Indiana

COWDERY, WARREN H.
Sinclair Refining Company
1301 Gratiot Street
St. Louis, Missouri

COWLEY, CLAUDE F.
Fiske Bros. Refining Co.
6-225 Gen. Mtrs. Building
Detroit 2, Michigan

COX, WILLIAM, JR.
Elco Lubricant Corp.
Jennings Road and Denison Ave.
Cleveland 9, Ohio

CRAIG, W. H.
Sharples Corp.
453 Hippodrome Annex
Cleveland, Ohio

CRAINE, S. D.
Socony Vacuum Oil Co.
59 E. Van Buren St.
Chicago, Ill.

CRAKER, PAUL
Luttrell Oil Co.
Box 1091
Tulsa, Oklahoma

CRANKSHAW, ALDEN
Acheson Colloids Corp.
50 Church Street
New York 7, New York

CRANKSHAW, EDWIN
Cleveland Graphite Bronze Co.
17000 St. Clair Street
Cleveland 10, Ohio

CRAWFORD, HOWARD T.
The Texas Co.
31 Terminal Way
Pittsburgh 19, Penna.

CREAN, ROBERT E.
Lincoln Engineering Co.
8627 Woodward Avenue
Detroit 2, Michigan

CREED, DAHL P.
The Texas Co.
1103 Marble St.
Youngstown, Ohio

CRENSHAW, GORDON P.
Tulsa Refined Oil Co.
Box 284 or 2540 Sand Springs Rd.
Tulsa, Oklahoma

CRIPE, G. D.
Sinclair Refining Co.
2540 West Cermak Road
Chicago 8, Ill.

CROGHAN, MICHAEL J., JR.
Lincoln Engineering Co.
5701 Natural Bridge Avenue
St. Louis 20, Missouri

CROWE, CHARLES H.
The Texas Co.
31st & Gray's Ferry Avenue
Philadelphia, Pennsylvania

CUNNINGHAM, GEORGE A.
Imperial Oil Ltd.
Halifax, Nova Scotia, Canada

CUTHBERT, WILLIAM LESLIE
Esso Standard Oil, S. A.
22 Abercrombie Street
P. O. Box 233
Port of Spain, Trinidad, B. W. I.

CYRUS, RALPH E.
Newport News Shipbuilding and
Dry Dock Co.
4101 Washington Avenue
Newport News, Virginia

DACUS, HUGH
Dacus Oil Co.
782 Minnesota Street
San Francisco 7, California

DAIGLER, FRANKLIN A.
Trico Products Corp.
817 Washington Street
Buffalo 3, New York

DALEY, LEO J.
Carnegie-Ill. Steel Corp.
Central Avenue
Johnstown, Pennsylvania

DANIEL, CHARLES E.
Shell Oil Co., Inc.
2015 Long Beach Ave.
Los Angeles, Calif.

DANSE, L. A.
General Motors Corp.
15-233 Gen. Mtrs. Bldg.
Detroit 2, Michigan

DARDING, GEORGE A.
6944 Silverton Avenue
Silverton 13, Ohio

DAVENPORT, ROBERT L.
C. F. Battenfeld Oil Co.
1340 Oakman Boulevard
Detroit 6, Michigan

DAVIS, GEORGE C.
Davis-Howland Oil Corp.
South Avenue at Griffith
Rochester 7, New York

DAVIS, GEORGE H.
Shell Oil Co., Inc.
523 Grant Building
Pittsburgh 19, Pennsylvania

DAVIS, JAMES B.
Monsanto Chemical Co.
1700 South Second
St. Louis 4, Mo.

DAY, ROY T.
The Ohio Oil Co.
600 South Hawley St.
Toledo 9, Ohio

DAY, WESLEY H.
Shell Oil Co., Inc.
2012 West 25th Street
Cleveland 1, Ohio

DEAKINS, H. B.
Gulf Oil Corp.
Gross Street & P.R.R.
Pittsburgh, Pennsylvania

DE ARDO, ANTHONY J.
Aluminum Co. of America
Aluminum Res. Labs.,
Box 772
New Kensington, Pa.

DE CHAZAL, P. M.
c/o The Stanley Tool Co. of
Canada, Ltd.
Roxton Pond P.
Quebec, Canada

DECHERT, CARL J.
Wyman-Gordon Co.
147th and Wood Streets
Harvey, Illinois

DE MARTONFALVY, IVAN C.
Bowser International, Ltd.
London, England

DEMMITT, CLYDE A.
Pure Oil Company
South Broadway at Albany St.
Dayton, Ohio

DEMPLER, ROBERT P.
Geo. P. Dempler Co.
711 Washington Road
Pittsburgh 16, Pennsylvania

DENIGAN, EDWARD P.
Blaw Knox Co.
829 Beaver Avenue
Pittsburgh 12, Pennsylvania

DEUTSCH, WILBUR
Trabon Eng. Co.
1814 E. 40th St.
Cleveland, Ohio

DEVER, HUBERT J.
Alemite Co. of Eastern Pa.
704 N. 16th Street
Philadelphia 30, Pennsylvania

DEWEY, MILTON A.
E. I. DuPont de Nemours & Co.
Wilmington, Delaware

DICKSON, JOE C.
Standard Oil Co. of Indiana
1011 Fourth Street
Detroit, Michigan

DIETZ, CARL
Johns-Manville Corp.
45 Prospect Avenue
Cleveland 15, Ohio

DIPPERT, D. L.
Panther Oil & Grease Mfg. Co.
P. O. Box 1351
Tacoma, Washington

DIRKES, CARL E.
Dirkes Industries, Inc.
2035 Gratiot
Detroit, Michigan

DISNEY, M. E.
United States Rubber Co.
1230 Sixth Avenue
New York 20, New York

DIX, RALPH GOODMAN
Cities Service Oil Co.
6611 Euclid Avenue
Cleveland 3, Ohio

DOHERTY, JOHN J.
Stewart-Warner Corp.
1826 Diversey Parkway
Chicago, Ill.

DONALDSON, JOHN
Apex Alkali Prod. Co.
Main & Rector Streets
Philadelphia 27, Pennsylvania

DONKER, A. E.
Honan-Crane Corp.
50 Church Street
New York, New York

DONNAN, GERALD C.
Panther Oil & Grease Mfg. Co.
1022 Charleville Place
Rock Hill 19, Missouri

DONNELLY, FRANCIS J.
Gibbs & Hill, Inc.
Pennsylvania Station
New York, New York

DOUGHERTY, G. T.
Standard Oil Co. (Ind.)
910 S. Michigan Avenue
Chicago 80, Illinois

DOUGHERTY, MORRELL E.
Acheson Colloids Corp.
1423 Land Title Building
Philadelphia 10, Pennsylvania

DOYLE, PAUL J.
Republic Steel Corp.
3100 E. 45th Street
Cleveland, Ohio

DRISCOLL, ROBERT E.
The Texas Co.
3516 E. New York
Indianapolis 2, Indiana

DRYER, JOHN P.
The Texas Company
6707 Dix Avenue
Detroit, Michigan

DUNCAN, G. W.
Standard Oil Dev. Co.
P. O. Box 243
Elizabeth, N. J.

DUNCAN, WILLIAM M.
D. A. Stuart Oil Co.
2727 S. Troy Street
Chicago, Illinois

DUNIGAN, JOHN HARMON
S. K. F.
Front and Erie Streets
Philadelphia, Pennsylvania

DUNN, LEWIS C.
E. F. Houghton & Company
7 East Grand Avenue
Detroit 3, Michigan

DUNNE, GEORGE R.
Honan-Crane Corp.
Lebanon, Indiana

DURAY, JOSEPH
Precision Scientific Co.
3737 W. Cortland St.
Chicago 47, Ill.

DURHAM, GEOFFREY A.
Shell Oil Co., Inc.
100 Bush Street
San Francisco 6, California

DYE, GEORGE H.
Socony-Vacuum Oil Co.
1445 W. 37th St.
Chicago 9, Illinois

DYER, GEORGE R.
Sinclair Refining Co.
573 West Peachtree
Atlanta, Ga.

DYKSTRA, EDWARD F.
7044 S. Chappell Ave.
Chicago, Illinois

EBERHARDT, P. W.
Walter Kidde & Co., Inc.
675 Main Street
Belleville 9, New Jersey

EBERLE, WILLIAM FREDERICK
The Neville Co.
Neville P. O.
Pittsburgh 25, Pennsylvania

EBLING, SNOWDEN
H. L. Yoh Co., Inc.
321 Chestnut Street
Philadelphia 6, Pennsylvania

EBREY, GLENN O.
Walter Kidde & Co., Inc.
675 Main Street
Belleville 9, New Jersey

EDGAR, JOHN A.
Shell Oil Co., Inc.
Martinez, Calif.

EDGHILL, JAMES G. B.
Esso Standard Oil Co.
(Caribbean) S. A.
Kingston, Jamaica

EDMISTON, O. S.
The Atlantic Refining Co.
P. O. Box No. 1354
Providence 1, R. I.

EDWARDS, FRAZIER M.
The Texas Co.
Raleigh, N. C.

EDWARDS, LEO M.
Gulf Oil Corp.
17 Battery Place
New York 4, New York

EGGER, CHARLES J.
Bowser, Inc.
1302 E. Creighton Avenue
Fort Wayne 2, Indiana

EGUIA, JULIO RICARDO
Yacimientos Petroliferos Fiscales
Diagonal Roque Saenz Pena 777
Buenos Aires, Argentina
South America

EHRET, E. J.
Farval Corp.
327 South LaSalle Street
Chicago 4, Illinois

EHRHART, GEORGE W.
Republic Steel Corp.
116th & Burley Streets
Chicago, Illinois

EHRLICH, MELVILLE
American Lubricants, Inc.
1575 Clinton Street
Buffalo 6, New York

EICHELBERGER, WILLARD C.
American Oil Co.
Baltimore St.
Baltimore, Md.

EIFERT, EDWARD J.
Union Oil Co.
Oleum, Calif.

EISMANN, WILLIAM, JR.
E. F. Houghton & Co.
303 W. Lehigh Avenue
Philadelphia 33, Pennsylvania

EITZEN, LOUIS C.
Louis C. Eitzen Co.
17 West 60th Street
New York 23, N. Y.

EKBERG, JOHN PAUL, Jr.
Monsanto Chemical Company
1700 South 2nd Street
St. Louis, Missouri

EKLUND, PHILLIP R.
Westinghouse Electric Corp.
Research Labs., Ardmore Blvd.
East Pittsburgh, Pennsylvania

ELLIMAN, SAMUEL
Vigzol Oil Refining Co.
113 Park Street
London, W 1, England

ELLIOTT, JOHN T.
E. F. Houghton and Company
7 E. Grand Avenue
Detroit 3, Michigan

ELLIOTT, STANLEY B.
Ferro Chemical Corp.
450 Krick Road
Bedford, Ohio

ELLIOTT, WILLIAM E.
Carnegie Illinois Steel
Braddock Avenue
Braddock, Pennsylvania

ELSHOFF, R. H.
Freedom-Valvoline Oil Co.
431 Main St.
Cincinnati 2, Ohio

ELVIN, KENNETH WILLIAM
Sun Oil Company
436 Doremus Avenue
Newark, N. J.

EMMONS, CLAUDE E.
The Texas Company
929 South Broadway
Los Angeles, California

ENDSLEY, LOUIS E., JR.
The Texas Co.
135 E. 42nd Street
New York, New York

ENGEL, RICHARD L.
Allis-Chalmers Mfg. Co.
458 S. Spring Street
Los Angeles, Calif.

ENNIS, H. E.
The Texas Co.
31 Terminal Way
Pittsburgh 19, Pennsylvania

EPPS, MAX
General Petroleum Corp.
108 W. 2nd St.
Los Angeles 12, California

ERCK, EDWARD H.
Bendix Aviation Corp.
Teterboro, N. J.

ERIKSON, CARL F.
Nathan Mfg. Co.
416 E. 106th Street
New York, New York

EVANS, ALLEN C.
The Texas Company
979 Grant St.
Akron 13, Ohio

EVANS, DOUGLAS N.
Inland Steel Co.
East Chicago, Indiana

EVANS, THOMAS J., JR.
Socony Vacuum Oil Co.
59 E. Van Buren St.
Chicago, Illinois

EVERITT, WILLIAM THEODORE
Eastman Kodak Co.
Kodak Park
Rochester, New York

EWBANK, WALTER J.
The University of Oklahoma School of Mechanical Engineering
Norman, Oklahoma

EWING, FRANCIS ROBERT
Master Lubricants Company
Meadow and Jackson Sts.
Philadelphia 48, Pennsylvania

FAERMANN, LEONIDAS
Arnaud Trading & Export Co.
Corrientes 1977
Buenos Aires, Argentina

FAHEY, JOSEPH J.
Faber Laboratories of N. Y.
51-57 Franklin Street
New York 13, New York

FAIRCHILD, SHERMAN M.
Fairchild Engine & Airplane Co.
30 Rockefeller Plaza
New York 20, New York

FARRINGTON, BRUCE B.
California Research Corp.
P. O. Box 1627
Richmond, California

FARRY, JAMES E.
Alemite Co.
1027 Main Street
Buffalo, N. Y.

FAST, JOHN F.
Socony-Vacuum Oil Co., Inc.
26 Broadway
New York 4, New York

FATOUT, RAY C.
Alvord Oil Co.
1501 S. Senate
Indianapolis 2, Indiana

FAUST, HARRY W.
Monsanto Chemical Co.
1700 South 2nd St.
St. Louis 4, Mo.

FAUVER, JOHN W.
J. N. Fauver Company
49 West Hancock Street
Detroit 1, Michigan

FAVILLE, FREDERICK A.
Faville-Le Vally Corp.
Rm. 2118—105 W. Adams St.
Chicago 3, Illinois

FELDHUSEN, HERMAN JR.
Standard Oil Co. of N. J.
20 Cairn Street
Rochester, New York

FENKER, GRAFTON F. J.
Pennsylvania Refining Co.
2686 Lisbon Road
Cleveland 4, Ohio

FERRIE, PARMELY T.
The J. W. Kelley Co.
3401 West 140th St.
Cleveland 11, Ohio

FEWSMITH, A. GRANT
Panther Oil & Grease Mfg. Co.
840 N. Main Street
Fort Worth 1, Texas

FIGLEWSKI, BENJAMIN
Sinclair Refining Co.
East Chicago, Indiana

FINDLAY, GEORGE
Republic Steel Corporation
1175 South Park Avenue
Buffalo 20, New York

FINK, SAM M.
Alemite Co. of Pittsburgh
201 Shady Avenue
Pittsburgh 6, Pennsylvania

FINKELMANN, JOHN L.
The Warren Refining & Chem. Co.
308 Euclid Avenue
Cleveland 14, Ohio

FINNERAN, PAUL J.
Standard Oil Co. of Ohio
P. O. Box 374
Zanesville, Ohio

FISCHER, RUDOLPH A.
The Texas Co.
1000 Rand Building
Buffalo 3, New York

FISHER, C. W.
Gulf Refining Co.
250 Jeff Street
Cleveland, Ohio

FISHER, FRANK G.
Honan-Crane Corp.
1200 Indianapolis Ave.
Lebanon, Indiana

FISKE, CHARLES D., Jr.
Bijur Lubricating Corp.
7-250 General Motors Bldg.
Detroit 2, Mich.

FITCH, L. W.
Dingle-Clark Co.
1248 Engineers Building
Cleveland 14, Ohio

FITZGERALD, CORNELIUS F.
The Stambaugh-Thompson Co.
P. O. Box 1528
Youngstown, Ohio

FLETCHER, HARRY B.
Sinclair Refininig Co.
630 Fifth Avenue
New York, New York

FLETCHER, H. J.
E. F. Houghton & Co.
3516 S. Shields Avenue
Chicago, Illinois

FLETCHER, W. A.
E. F. Houghton & Co.
Quint & Davidson
San Francisco 24, California

FLICK, B. B.
E. F. Houghton & Co.
4500 Euclid Avenue
Cleveland, Ohio

FLINT, CHARLES K., JR.
Tennessee Eastman Corp.
Kingsport, Tennessee

FLYNN, ROLAND W.
Gulf Oil Corp.
17 Battery Place
New York 4, N. Y.

FOHL, HARRY A.
Lukens Steel Co.
Coatesville, Pa.

FOSTER, CHARLES H.
The Atlantic Ref. Co.
260 S. Broad St.
Philadelphia 2, Pa.

FOUCH, JOHN E.
Standard Oil Co. of California
533 Jergins Trust Bldg.
Long Beach 2, California

FOWLER, BURTON C.
Socony-Vacuum Oil Co.
130 Pearl Street
Buffalo 3, New York

FOWLER, WILLIAM H.
The Pure Oil Res. & Dev. Labs.
Box 266
Winnetka, Ill.

FOX, ALEX P.
Lincoln Engineering Co.
5701 Natural Bridge Avenue
St. Louis 20, Missouri

FRAHER, WILLIAM D., JR.
American Oil Co.
Tryon & Morehead Sts.
Charlotte, N. C.

FRAIN, COURTLAND B.
Union Oil Co. of Calif.
617 W. 7th Street
Los Angeles 14, California

FRANKLIN, WALTER K.
Shell Oil Co., Inc.
1008 West 6th St.
Los Angeles 14, California

FRANTZ, LEROY J.
The Texas Co.
1020 N. Quebec St.
Allentown, Pa.

FRARY, EDWARD J.
Union Oil Co. of Calif.
30 E. Tujunga
Burbank, California

FRASER, HAROLD M.
International Lubricant Corp.
P. O. Box 390
New Orleans 1, Louisiana

FRAZIER, CHARLES H.
The Torrington Co.
16004 Detroit Avenue
Cleveland 7, Ohio

FREDERICKS, DONALD E.
L. R. Kerns Co.
2657 East 95th St.
Chicago 17, Illinois

FREDERICKS, W. CARLETON
Standard Oil Co. (Ind.)
910 South Michigan Avenue
Chicago 80, Illinois

FREDERICKSON, VERNON W.
Union Oil Co. of Calif.
Oleum, California

FREEMAN, EDWIN W.
Cities Service Refining Corp.
Hodges Street
Lake Charles, Louisiana

FREMON, E. B.
Socony Vacuum Oil Co., Inc.
4140 Lindell Street
St. Louis 8, Missouri

FRIER, JAMES H.
Kaiser Company, Inc.
Iron & Steel Div.
Fontana, California

FRIER, JAMES W.
Alemite Co. of So. Calif.
333 W. Washington St.
Los Angeles, California

FRISBIE, HOWARD C.
E. F. Houghton & Co.
303 W. Lehigh
Philadelphia, Pennsylvania

FROHMAN, OSCAR
Ampco Metal, Inc.
1745 South 38th St.
Milwaukee 4, Wis.

FRONING, J. F.
E. I. du Pont de Nemours & Co.
P O. Box 525
Wilmington, Delaware

FUHR, WAYNE S.
Hanna Coal Co.
St. Clairsville, Ohio

FULLER, DUDLEY D.
Columbia University
Department of Mechanical Engr.
New York 27, New York

FUREY, JOHN L.
Swan-Finch Oil Corp.
R. C. A. Building, West
New York 20, New York

FURGASON, C. A.
Ladish Drop Forge Co.
P. O. Box F
Cudahy, Wisconsin

FURJANIC, JOHN J.
Standard Oil Co. of Pa.
437 S. Queen Street
York, Pennsylvania

GALLOWAY, WILLIAM S.
Gulf Refining Co.
941 Maison Blanche Bldg.
New Orleans 1, Louisiana

GARDNER, ROBERT H.
Sinclair Refining Co.
Harvey Labs.
Harvey, Illinois

GARNEY, CHARLES F.
Socony-Vacuum Oil Co., Inc.
59 E. Van Buren Street
Chicago, Illinois

GARRISON, EUGENE J.
Canfield Oil Co.
3216 E. 55th Street
Cleveland, Ohio

GATES, PAUL J.
The F. D. Johnson Co.
1814 East 40th Street
Cleveland 3, Ohio

GAUDREAU, PAUL A.
Saco Lowell Shops
Biddeford, Maine

GAUL, JOHN W.
Texas Co.
Rand Bldg.
Buffalo 3, New York

GEEN, CORY P.
Sun Oil Co.
1608 Walnut St.
Philadelphia 3, Pennsylvania

GEISINGER, CHARLES A.
B. F. Goodrich Co.
500 S. Main St.
Akron 18, Ohio

GENTHE, WALTER A.
The Texas Co.
332 South Michigan Avenue
Chicago 4, Illinois

GEORGI, CARL W.
Quaker State Oil Refining Corp.
164 Chandler Street
Buffalo 7, New York

GERIN, FERNAND L.
The Gerin Corp.
P. O. Box 653
Red Bank, New Jersey

GERSTUNG, H. S.
Sinclair Refining Co.
630 Fifth Ave.
New York 20, N. Y.

GETTY, WILLIAM D.
Alemite Co. of Pittsburgh
201 Shady Avenue
Pittsburgh 6, Pennsylvania

GIBBONS, MARTIN J.
Fiske Bros. Ref. Co.
P. O. Box 38, Sta. "A"
Toledo 5, Ohio

GIEG, CHARLES F.
Shell Oil Co., Inc.
1725 E. Market Street
Akron, Ohio

GILBRETH, WILLIAM M.
Gulf Oil Corp.
17 Battery Place
New York 4, New York

GILL, FRANK P.
Adam Cook's Sons Inc.
5 Stiles Street
Linden, New Jersey

GILLETTE, CHARLES R.
New Departure Div., Gen. Mtrs. Corp.
269 N. Main St.
Bristol, Connecticut

GITZEN, JOSEPH A.
Delta Oil Products Co.
6263 North Teutonia Avenue
Milwaukee 9, Wisconsin

GLASHOFF, HOWARD I.
American Oil Co.
1001 Eastern Avenue
Baltimore 2, Maryland

GLASS, EDWARD M.
Hq. Air Material Command, AAF
Wright Field
Dayton, Ohio

GLENN, BRUCE W.
L. R. Kerns Co.
2657 East 95th Street
Chicago 17, Illinois

GLOECKLER, ALFRED P.
New Idea—Div. AVCO Mfg. Corp.
Coldwater, Ohio

GOBLE, R. D.
Skinner Purifiers, Inc.
1500 Trombly Ave.
Detroit 11, Michigan

GODARD, P. W.
Sinclair Refining Co.
573 W. Peachtree Street
Atlanta 1, Georgia

GODDARD, HOMER A.
Gulf Oil Corp.
Gross Street and P. R. R.
Pittsburgh 6, Pennsylvania

GODSHALL, J. BYRON
Ingersoll--Rand Co.
Phillipsburg, N. J.

GOEHRING, CLIFFORD C.
Standard Oil Co. of N. J.
17 Battery Place
New York, New York

GOLDEN, JOHN O.
International Harvester Co.
1360 59th Street
Emeryville, Calif.

GOLDSBOROUGH, F. C.
Sun Oil Co.
1608 Walnut Street
Philadelphia 3, Pennsylvania

GORDON, DAVID B
Socony-Vacuum Oil Co., Inc.
230 Park Ave.
New York, New York

GORDON, JAMES A.
James T. Gordon Co.
233 Broadway
New York 7, New York

GORDON, ROBERT M.
Gordon Lubricating Co.
Gregg Street
Carnegie, Pennsylvania

GORNEY, HENRY E.
Standard Register Co.
626 Albany St.
Dayton 1, Ohio

GORSLINE, ROBERT J.
S. F. Bowser Co., Ltd.
183 George St.
Toronto, Ontario, Canada

GOTHARD, N. J.
Sinclair Refining Co.
East Chicago, Indiana

GOTTFRIED, NORMAN M.
Carnegie-Illinois Steel Corp.
DuQuesne Works
DuQuesne, Pa.

GOTTSCHALL, ALVIN G.
Gulf Refining Co.
Box 1470
Hattiesburg, Mississippi

GOWER, CHARLES ARTHUR EDW.
Socony Vacuum Oil Co., Inc.
Federal Reserve Bank Building
Kansas City, Missouri

GRAF, FRANK J.
Otis Proving Stand Corp.
40 Rector Street
New York 6, New York

GRAHAM, HENRY T.
Standard Oil Co. of California
225 Bush St.
San Francisco, California

GRAMS, HAROLD W.
The Texas Co.
300 Baker Building
Minneapolis 2, Minnesota

GRASSO, L. A.
The Texas Co.
31 Terminal Way
Pittsburgh 19, Pennsylvania

GRATIOT, JULES D.
Honan-Crane Corp.
1968 Riverside Drive
Los Angeles 26, California

GRAVES, ELDON F.
Dow Chemical Co.
Midland 8, Michigan

GRAY, ALEXANDER B.
Crawford Emulsions
1415-19 Berger Bldg.
Pittsburgh 19, Pa.

GRAY, DONALD S.
Armour Research Foundation
35 West 33rd St.
Chicago 16, Ill.

GRAY, FRANK L.
Carnegie-Ill. Steel Corp.
Gary Steel Works
Gary, Indiana

GRAY, JOHN M.
Cities Service Oil Co.
4535 S. Oklahoma
Box 4577
Oklahoma City 9, Oklahoma

GRAY, L. L.
Gray Company, Inc.
60 Eleventh Avenue, N. E.
Minneapolis, Minnesota

GRAYBILL, DONALD A.
The J. W. Kelley Co.
3401 West 140th Street
Cleveland 11, Ohio

GREEN, ARTHUR F.
62 La Salle Road
Hartford 7, Connecticut

GREEN, EDWARD G.
Allison Div., G.M.C.
Indianapolis 6, Indiana

GREENBAUN, NICHOLAS P.
Socony-Vacuum Oil Co.
17 W. Market
Indianapolis, Indiana

GREGG, James K.
Perfect Circle Co.
Hagerstown, Ind.

GREGG, LOUIS A.
Shell Oil Co., Inc.
1415 Liberty Life Building
Charlotte 3, North Carolina

GRESSEL, A. S.
Stevens Grease & Oil Co.
7299 Bessemer
Cleveland 4, Ohio

GRIMMER, LANE E.
National Refining Co.
Glesnor Avenue
Findlay, Ohio

GROFF, J. L. E.
Institut Francais du Petrole
Rue De Lubeck 2
Paris 16, France

GRUENERT, RUSSELL L.
Bijur Lubricating Corp.
7-250 General Motors Bldg.
Detroit, Michigan

GUNTHER, RAYMOND C.
Socony-Vacuum Oil Co.
6th & Chestnut Sts.
Philadelphia 6, Pa.

GUSTAFSON, JACK H.
Marlin-Rockwell Corp.
402 Chandler Street
Jamestown, New York

HAAS, H. A.
Blackmer Pump Co.
915 Union Trust Building
Pittsburgh 19, Pennsylvania

HAFNER, HENRY F., JR.
Jos. H. Yerkes & Co.
3715 Washington Ave.
St. Louis 8, Mo.

HAGAN, R. J.
Republic Steel Corp.
Youngstown 1, Ohio

HAGER, H. R.
Sun Oil Co.
990 Home Avenue
Akron, Ohio

HAGERMAN, WILLIAM A.
Worth Steel Co.
Claymont, Delaware

HAGGERTY, ALLAN J.
Hagerty Refining Co.
50 South St.
New York 5, New York

HALDEMAN, RUSSEL R.
De Laval Steam Turbine Co.
853 Nottingham Way
Trenton 2, New Jersey

HALL, FRED V.
Calif. Research Corp.
324 El Segundo Blvd.
El Segundo, Calif.

HALL, JAMES F.
Ironsides Co.
270 West Mound Avenue
Columbus 15, Ohio

HALL, R. W.
The Texas Co.
720 San Jacinto Street
Houston, Texas

HALWACHS, J. P.
Tidewater Associated Oil Co.
1510 Arrott Bldg.
Pittsburgh 22, Pa.

HAMILTON, LYLE A.
Socony Vacuum Oil Co.
General Labs.
Paulsboro, N. J.

HAMMER, WILLIAM C.
Sharvania Oil & Grease Corp.
P. O. Box 1550
Memphis, Tennessee

HAMMERSTEIN, FRED J.
Socony-Vacuum Oil Co.
59 E. Van Buren St.
Chicago, Ill.

HANSON, THOMAS E.
Technical Publishing Co.
53 W. Jackson
Chicago 4, Illinois

HAMPTON, FRANK W.
Alemite Co. of Pittsburgh
201 Shady Avenue
Pittsburgh 6, Pennsylvania

HARDIN, MAX C.
Allison Div., G.M.C.
Indianapolis, Indiana

HARDY, FRANK
Bell Telephone Labs.
463 West St.
New York 14, N. Y.

HARKINS, EDWIN D., SR.
Farval Corporation
2842 W. Grand Boulevard
Detroit, Michigan

HARPER, H. LEONARD
Aluminum Company of America
Gulf Building
Pittsburgh 19, Pennsylvania

HARRIS, E. R.
Alemite Div.,
Stewart-Warner Corp.
1826 Diversey Parkway
Chicago 14, Illinois

HARRIS HENRY M. T.
National Bearing, Div. Brake Shoe
4930 Manchester
St. Louis 10, Missouri

HARRIS, SIDNEY GERALD
Petroleum Solvents Corp.
331 Madison Ave.
New York 17, N. Y.

HART, ALAN
The Franklin Oil & Gas Co.
Bedford, Ohio

HARTMAN, KENNETH D.
Pettibone Mulliken Corp.
4710 W. Division Street
Chicago, Illinois

HASSENFRITZ, JOHN F.
The Natl. Ref. Co.
1425 Circle Tower Building
Indianapolis 4, Indiana

HASTINGS, S. A.
Crane Packing Company
4418 N. Clark St.
Chicago 40, Illinois

HATCH, FRANK R.
Shell Oil Co., Inc.
100 Bush St.
San Francisco 6, California

HATTRICK, THOMAS J.
The Texas Co.
P. O. Box 363
Bloomsburg 8, Pennsylvania

HAUFE, TED B.
Universal Oil Products Co.
310 S. Michigan Avenue
Chicago 4, Illinois

HAUSER, CHARLES J.
Sun Oil Co.
760 Brooks Avenue
Rochester, New York

HAZENFIELD, MILO C.
Lincoln Engineering Co.
1541 Land Title Building
Philadelphia 10, Pennsylvania

HEAD, GEORGE P.
Mergraf Oil Prod. Co., Inc.
Box No. 95
Northville, Michigan

HEBNER, GEORGE E.
Davis-Howland Oil Corp.
South Avenue at Griffith
Rochester 7, New York

HEDDING, JULIAN R.
Shaw Sales & Service Co.
5100 Anaheim Telegraph Road
Los Angeles 22, California

HEILAND, JOHN G.
Bell and Howell
7100 N. McCormick Rd.
Chicago, Ill.

HEINTZE, ARTHUR L.
Sinclair Ref. Co.
630—5th Ave.
New York 20, N. Y.

HELMBOLDT, GEORGE R.
Pittsburgh Steel Co.
Donner & 12th Streets
Monessen, Pennsylvania

HELTNE, LESTER C.
Globe Steel Tubes Co.
3839 West Burnham
Milwaukee, Wis.

HEMMINGWAY, HUGH L.
The Pure Oil Co.
35 E. Wacker Drive
Chicago 1, Illinois

HENDRICKS, DANIEL E., JR.
Shell Oil Co., Inc.
37-06 82nd Street
Jackson Heights, New York

HENKEL, HULL
Metal Lubricants Co.
3211 S. Wood Street
Chicago 8, Illinois

HENRY, ROBERT W.
Phillips Petroleum Co.
Refining Dept.
Bartlesville, Okla.

HEROT, FREDERICK C.
The J. W. Kelley Co.
3401 West 140th St.
Cleveland 11, Ohio

HERSEY, MAYO D.
U. S. Naval Eng. Expt. Station
Annapolis, Maryland

HEWITT, FREDERICK M.
Bijur Lubricating Co.
7-250 General Motors Bldg.
Detroit 2, Michigan

HEWITT, JAMES R.
Joseph Woodwell Co.
N. W. Cor. Wood St. & Blvd. of Allies
Pittsburgh 22, Pennsylvania

HEYER, ARTHUR J.
Anchor Hocking Glass Corp.
Plant No. 1
Lancaster, Ohio

HIGGINS, EDWIN M.
Master Lubricants Co.
Meadow and Jackson Sts.
Philadelphia, Pennsylvania

HILLER, ED.
Essex Brass Corp.
2000 Franklin Street
Detroit 7, Michigan

HISLOP, LAWRENCE D.
Standard Oil Co. of Pa.
35th and A. V. R. R.
Pittsburgh, Pennsylvania

HOCKE, JAMES N.
Talon, Inc.
626 Arch Street
Meadville, Pennsylvania

HODSON, ELLIOTT W.
Hodson Corp.
5301 W. 66th Street
Chicago 38, Illinois

HODSON, LEE N.
Hodson Corp.
5301 W. 66th Street
Chicago 38, Illinois

HODSON, WALTER H.
Hodson Corp.
5301 W. 66th Street
Chicago 38, Illinois

HOFFMAN, LESLIE A.
Leslie A. Hoffman Associates
1115 Main Street
Bridgeport 3, Connecticut

HOFFMANN, GEORGE
Elco Lubricants Corp.
Jennings Rd. and Dennison Ave.
Cleveland 9, Ohio

HOFFMEISTER, LEWIS N.
Sinclair Ref. Co.
1502 Kentucky Avenue
Indianapolis, Indiana

HOFMEISTER, HAROLD P.
Socony-Vacuum Oil Co.
907 South 1st St.
Milwaukee, Wisconsin

HOLDSWORTH, GEORGE D.
Standard Oil Co. of N. J.
50 Rockefeller Plaza
New York 20, New York

HOLLAND, LEONARD C.
Shell Oil Co., Inc.
100 Bush St.
San Francisco, California

HOLLINGSWORTH, DWIGHT F.
E. I. duPont deNemours and Co.
1007 Market Street
Wilmington 98, Delaware

HOLLISTER, WILLIAM H.
The Texas Co.
26 Hansing St.
Buffalo, N. Y.

HOLMBERG, BRUCE J.
Socony Vacuum Oil Co.
59 E. Van Buren St.
Chicago 5, Illinois

HOLMES, ROBERT L.
Route 1, Box 1
Riverside, California

HOLT, JAMES OSCAR
Sinclair Refining Co.
573 West Peachtree St.
Atlanta, Georgia

HOMRIGHOUSE, L. E.
The Texas Co.
Miller Road
Fort Wayne, Indiana

HOOCK, WILLIAM S.
Sinclair Ref. Co.
1301 Gratiot Street
St. Louis, Missouri

HOOD, WALTER S.
Hood Refining Co.
21 N. Hamilton St.
Greensburg, Pa.

HOPKINSON, JAMES W.
Penn-Petroleum Corp.
7131 Westfield at Burnette
Detroit 4, Michigan

HOPPES, LAWRENCE D.
7860 S. Shore Drive
Chicago 49, Illinois

HORWITZ, Albert S.
E. F. Houghton & Co.
Quint and Davidson
San Francisco, California

HORWITZ, WALTER N.
Sun Oil Co.
1608 Walnut St.
Philadelphia 3, Pa.

HOWARD, CHARLES I.
Pontiac Motor Div.
Glenwood Avenue
Pontiac, Michigan

HOWELL, K. M.
Standard Oil Co. (Ohio)
1315 Poland Ave.
Youngstown 8, Ohio

HUBBELL, H. W.
United Oil Co.
1800 N. Franklin Street
Pittsburgh 12, Pennsylvania

HUDEPOHL, D. C.
Gray Co., Inc.
60 11th Avenue, N.E.
Minneapolis, Minnesota

HUEBBLER, CHARLES D.
The Texas Co.
6707 Dix
Detroit, Michigan

HUEY, CHARLES L.
Aluminum Co. of America
Davenport, Iowa

HUISKEN, ARTHUR H.
Sinclair Ref. Co.
2540 W. Cermak Rd.
Chicago 8, Illinois

HULETT, W. E.
Socony-Vacuum Oil Co.
59 E. Van Buren St.
Chicago 5, Illinois

HULME, C. E.
Kendall Ref. Co.
77 N. Kendall Avenue
Bradford, Pennsylvania

HUNTER, B. F.
Honan-Crane Corp.
Lebanon, Ind.

HUNTOON, CALVIN B.
Shell Oil Co., Inc.
290 Larkin St.
Buffalo, N. Y.

HURD, WILLIAM P., SR.
Socony-Vacuum Oil Co.
1422 Euclid Ave.
Cleveland 15, Ohio

HURTT, W. T.
United Oil Co.
1800 N. Franklin St.
Pittsburgh 12, Pa.

HURWITZ, WILLIAM S.
The Texas Co.
Houston, Ave.
Port Arthur, Texas

HUTTON, VIRGIL C.
Delco Products Div. of G. M.
329 E. First St.
Dayton, Ohio

IRGENS, F. T.
Evinrude Motors
4143 N. 27th Street
Milwaukee 9, Wisconsin

IRION, HARRY W.
National Ref. Co.
1885 Coventry Road
Columbus 12, Ohio

IRVIN, WILLIAM E., JR.
National Tube Co.
Lorain, Ohio

ISBELL, HARVEY G.
Industrial Laboratory
U. S. Navy Yard
Mare Island, California

JACKSON, DUDLEY C.
Trabon Engineering Corp.
1814 East 40th St.
Cleveland 3, Ohio

JACKSON, PHILIP G.
Allison Div., G.M.C.
Pt. 3 Speedway
Indianapolis, Indiana

JACOBS, LOUIS F.
Minnesota Mining & Mfg. Co.
900 Fauier Avenue
St. Paul 6, Minnesota

JACOBSEN, PAUL W.
Honan-Crane Corp.
State Bank Bldg.
743 N. Fourth St.
Milwaukee 3, Wisconsin

JACOBSON, A. E.
H. K. Stahl Co.
2314 Wycliff St.
St. Paul 4, Minn.

JAESCHKE, ALFRED F.
National Ref. Co.
Hanna Building
Cleveland, Ohio

JAMESON, HERBERT B.
Petroleum Equipment Co.
3117 N. Broad Street
Philadelphia 32, Pennsylvania

JANKE, AL
Cincinnati Milling Machine Co.
Cimcool Div.
Marburg Avenue
Cincinnati 9, Ohio

JARRELL, J. R.
Socony-Vacuum Oil Co.
806 Hayden Street
Fort Wayne, Indiana

JENKINS, JOSEPH J.
Lincoln Engrg. Co.
5730 Natural Bridge Avenue
St. Louis 20, Missouri

JENKINS, WESLEY R.
Carnegie Illinois Steel Corp.
3426 East 89th Street
Chicago, Illinois

JENNINGS, A. J.
The Farval Corp.
3249 East 80th Street
Cleveland 4, Ohio

JENNINGS, BURGESS H.
Northwestern Technological Inst.
Dept. of Mech. Engr.
Sheridan Road and Noyes Street
Evanston, Illinois

JESTER, MAXWELL B.
Calumet Refining Co.
P. O. Box 1167
Shreveport, Louisiana

JESTER, S. VAN T., JR.
Shell Oil Company
50 W. 50th Street
New York 20, New York

JOACHIM, W. B.
Tide Water Associated Oil Co.
1616 Walnut Street
Philadelphia 3, Pennsylvania

JOHN, DAVE M.
Lincoln Engrg. Co.
2850 Broadway
Oakland 11, California

JOHN, JAMES W., JR. . .
Eastman Kodak Co.
Kodak Park
Rochester, New York

JOHNSON, ALBERT S.
Freedom-Valvoline Oil Co.
440 E. Silver Spring Dr.
Milwaukee 11, Wis.

JOHNSON, ALLEN W.
Trico Products Corp.
817 Washington Street
Buffalo, New York

JOHNSON, CHARLES B.
Pittsburgh Equitable Meter Co.
400 North Lexington Avenue
Pittsburgh 8, Pennsylvania

JOHNSON, CURTIS H.
Socony-Vacuum Oil Co.
59 E. Van Buren St.
Chicago 5, Illinois

JOHNSON, DARRYL W.
Standard Oil Co.
414 West Michigan Street
Milwaukee 1, Wisconsin

JOHNSON, FRANK D.
Trabon Engineering Corp.
1814 East 40th Street
Cleveland, Ohio

JOHNSON, MARTIN A., JR.
Socony-Vacuum Oil Co.
59 E. Van Buren Street
Chicago, Illinois

JOHNSON, WILLIAM O.
Gulf Refining Co.
230 N. Michigan Ave.
Chicago, Illinois

JOHNSTON, H. W.
Standard Oil Co.
1706 Midland Bldg.
Cleveland, Ohio

JOHNSTON, J. L.
Shell Oil Company, Inc.
P. O. Box 95
Wilmington, California

JONES, H. R., Jr.
Gulf Oil Corp.
Gross St. and P. R. R.
Pittsburgh 6, Pennsylvania

JONES, HAROLD W.
Penola, Inc.
221 N. La Salle Street
Chicago 1, Illinois

JONES, M. C.
Youngstown Sheet & Tube Co.
Purchasing Dept.
Youngstown 1, Ohio

JONES, STUART G.
Imperial Oil, Ltd.
1027 St. Luke Road
Windsor, Ontario, Canada

JONES WILLIAM
Gulf Oil Corp.
Gross Street & P. R. R.
Pittsburgh, Pennsylvania

JONES, WILLIAM CARTER
Carbide and Carbon Chemicals Co.
311 Ross St.
Pittsburgh 19, Pa.

JOSEPHSON, ROBERT H.
Cleveland Graphite Bronze Co.
17000 St. Clair Avenue
Cleveland 10, Ohio

JOSSMAN, WALLACE
The Alemite Co.
15501 Woodrow Wilson
Detroit 3, Michigan

JUDS, ARTHUR F.
A. F. Juds Oil Co.
531 South Water Street
Milwaukee 4, Wisconsin

JUSTICE, R. W.
E. F. Houghton & Co.
860 Pennsylvania Ave.
Youngstown 4, Ohio

KANE, J. F.
The Texas Co.
135 E. 42nd Street
New York 17, New York

KANNADY, ARTHUR H.
Standard Oil Co. of California
533 Jergins Trust Bldg.
Long Beach 2, California

KARTHAUSER, CARL A.
207 Investment Building
Pittsburgh 22, Pennsylvania

KASE, EARL M.
Phillips Petroleum Co.
7. S. Dearborn Street
Chicago 3, Illinois

KASMARK, J. W.
Lincoln Engrg. Co.
2028 E. 46th Street
Cleveland, Ohio

KASPROW, FELIX A.
The National Auto. Products Co.
23 Whiting Street
New Britain, Connecticut

KATZ, WILLIAM B
Van Straaten Chemical Co.
134 N. LaSalle Street—Rm. 1700
Chicago 2, Illinois

KAVANAGH, F. W.
California Research Corp.
576 Standard Ave.
Richmond, California

KAYSER, HENRY W.
The Falk Corp.
3001 W. Canal St.
Milwaukee 8, Wisconsin

KEATING, HAROLD B.
Shell Oil Co., Inc.
Martinez Refinery
Martinez, California

KEIER, WILLIAM H.
Fiske Bros. Refining Co.
1500 Oakdale Avenue
Toledo 5, Ohio

KELLER, HARRY B.
Gordon Lub. Co.
Carnegie, Pennsylvania

KELLEY, GEORGE E.
Atlantic Refining Co.
260 S. Broad Street
Philadelphia 1, Pennsylvania

KELLY, EDWARD S.
The Budd Company
12141 Charlevoix Avenue
Detroit 14, Michigan

KEMMERER, HAROLD RICHARD
Shell Oil Co., Inc.
Box 262
Wood River, Illinois

KENNEDY, E. L.
Cato Oil and Grease Co.
1808 N. E. 9th St.
P. O. Box 172
Oklahoma City 1, Oklahoma

KENYON, RUSSELL W.
L. R. Kerns Co.
6432 Cass Ave.
Detroit, Michigan

KERNS, FRANK C.
The Texas Co.
135 East 42nd St.
New York 17, New York

KERNS, L. R.
L. R. Kerns Co.
2657 East 95th St.
Chicago, Illinois

KERRUISH, JOHN R., JR.
Esso Standard Oil Co.
1007 Dixwell Avenue
Hamden 14, Connecticut

KERSHNER, DANIEL C.
Alox Corp.
Box 556
Niagara Falls, N. Y.

KIMBALL, STERLING O.
AC Spark Plug Div., GMC
1300 N. Dort Highway
Flint, Mich.

KIMPEL, CLINTON B.
Carnegie Illinois Steel Corp.
Duquesne, Pennsylvania

KING, GEORGE R.
Buffalo Tank Corporation
P. O. Box 16
Buffalo, New York

KING, HAROLD M.
Standard Oil Company (Ohio)
1801 E. First St.
Dayton 3, Ohio

KING, RUSSELL F.
Jos. H. Yerkes & Co.
3715 Washington Ave.
St. Louis 8, Mo.

KINSEY, JOHN D.
The Farval Corp.
327 South LaSalle Street
Chicago 4, Illinois

KIPP, E. M.
Aluminum Co. of America
New Kensington, Pennsylvania

KIRKWOOD, ARCH B., JR.
American Lubricants, Inc.
1575 Clinton Ave.
Buffalo 6, New York

KLASING, GEORGE V.
Alemite Co.
59 East 25th St.
Chicago 16, Illinois

KLINE, WARREN M.
Lincoln Engineering Co.
2028 E. 46th Street
Cleveland 3, Ohio

KLOPP, JOHN A.
Reilly-Whiteman-Walton Co.
P. O. Box 188
Conshohocken, Pennsylvania

KLUMB, ROY L.
Jos. Schlitz Brewing Co.
235 W. Galena Street
Milwaukee 12, Wisconsin

KNAPP, ELWOOD F.
Aro Equip. Corp.
Bryan, Ohio

KNAPPER, R. H.
American Instrument Co.
P. O. Box 9116
Pittsburgh 24, Pa.

KNOPE, WILLIAM O.
Sinclair Ref. Co.
1761 Waterman
Detroit 9, Michigan

KOCH, CLIFFORD
Canfield Oil Co.
3216 East 55th Street
Cleveland 4, Ohio

KOELLING, ROBERT K.
Farval Corp.
327 S. LaSalle Street
Chicago, Illinois

KOFFMAN, EDWARD W.
American Cyanamid Co.
30 Rockefeller Plaza
New York 20, New York

KOLARIK, IVAN S.
Aluminum Research Lab.
New Kensington, Pa.

KORN, JAMES E.
Canfield Oil Co.
3216 E. 55th Street
Cleveland 4, Ohio

KOVACS, JULES P.
Purolator Prod., Inc.
744 Broad Street
Newark 2, New Jersey

KOVARIK, FRANK
Gits Brothers Manufacturing Co.
1846 S. Kilbourn Avenue
Chicago 23, Illinois

KRAATZ, ALFRED A.
U. S. Norfolk Naval Shipyards
Shop Superintendent's Office
Portsmouth, Virginia

KRAEMER, HERMAN C.
Servel, Inc.
Morton Avenue
Evansville 20, Indiana

KRAFT, O. L.
The Ohio Oil Co.
121 E. Maryland
Indianapolis, Indiana

KRAUS, CHARLES I.
Alemite Co. of Minn.
1226 Harmon Place
Minneapolis 3, Minn.

KRAUS, ROBERT A.
Republic Steel Co.
116th and Burley Street
Chicago, Illinois

KRAUSE, RICHARD H.
Allis Chalmers Mfg. Co.
112e South 70th St.
Milwaukee 14, Wisconsin

KRAUSE, WALLACE H.
Allis Chalmers Mfg. Co.
112e South 70th St.
Milwaukee 14, Wisconsin

KRAWETZ, J.
Phoenix Chemical Lab., Inc.
3953 Shakespeare
Chicago 47, Ill.

KRESS, JOHN A.
Rochester Gas & Elec. Co.
89 East Avenue
Rochester, New York

KRESTAN, JOHN H.
Battenfeld Grease & Oil Co.
P. O. Box 144
North Tonawanda, New York

KRIMMEL, HARRY F.
Alemite Co. of East Pa.
704 West 16th St.
Philadelphia 30, Pennsylvania

KRUMMELL, HARRY D.
Socony-Vacuum Oil Co., Inc.
59 E. Van Buren St.
Chicago, Illinois

KRUSE, ROBERT B.
Lincoln Engrg Co.
1924 Broadway
New York 23, New York

KUEBLER, WILLIAM P.
Westinghouse Elec. Corp.
South Philadelphia Works
Lester P. O.
Philadelphia, Pennsylvania

KUHLMAN, O. F.
Fiske Bros. Ref. Co.
Box 38, Station A
Toledo 5, Ohio

KUNTZE, ERNEST A.
Sinclair Refining Co.
Green Bay, Wisconsin

KURDI, HAMDI EL
Standard Oil Co. of Egypt
22, Kasr el Nil Str.
Cairo, Egypt

KUREM, SAIM
Petrol Ofisi
Kozluca Han
Galata, Istanbul, Turkey

KYROPOULOS, PETER
California Inst. of Tech.
1201 E. California St.
Pasadena 4, California

KYROPOULOS, SPYRO
California Inst. of Tech.
1201 E. California St.
Pasadena 4, California

LA FLEUR, H. W.
Sinclair Ref. Co.
2540 Cermak Road
Chicago, Illinois

LAGERGREN, C. S.
Sinclair Ref. Co.
2540 W. Cermak Road
Chicago, Ill.

LAKE, THORNTON
P. D. Johnson Co.
1814 East 40th Street
Cleveland, Ohio

LAMPHIER, JOHN O.
United States Air Force
Hq., Air Mat. Command
Wright Field
Dayton, Ohio

LAMPMAN, EDWIN A.
Acheson Colloids Corp.
200 Magee Bldg.
Pittsburgh, Pennsylvania

LAMPERT, CHARLES E. C.
Gulf Refining Co.
P. O. Box 157
Johnson City, Tennessee

LAMPORT, BERT J.
United Eng. & Fdy. Co.
1st National Bank Building
Pittsburgh, Pennsylvania

LANDIS, WARREN C.
Shell Oil Co., Inc.
909 E. 22nd Street
Baltimore 18, Maryland

LANG, WALTER B.
Acheson Colloids Corp.
Port Huron, Mich.

LANGER, THEODORE W.
Linde Air Prod. Co.
Tonawanda, New York

LANGWORTHY M. L.
The Texas Co.
135 East 42nd Street
New York 17, New York

LARSEN, ROBERT G.
Shell Development Co.
Emeryville 8, California

LARSON, C.M.
Sinclair Refining Co.
630 Fifth Avenue
New York 20, New York

LATOUR, CLIFFORD S.
E. F. Houghton & Co.
3516 S. Shields Ave.
Chicago 9, Illinois

LAUDIG, J. J.
Delaware, Lackawanna & Western
R. R. Co.
Scranton 5, Pa.

LAWRENCE, JOHN W.
Elco Lubricant Corp.
Jennings and Dennison Streets
Cleveland 9, Ohio

LAWTON, MORGAN B.
Lincoln Engineering Co.
8627 Woodward Ave.
Detroit 2, Mich.

LAWTON, ROBERT P.
Standard Oil Co. of Pa.
1213 N. Plymouth Street
Allentown, Pennsylvania

LEE, ALBERT E.
Enjay Co., Inc.
15 W. 51st Street
New York 19, New York

LEFFEL, GUY H.
D. A. Stuart Oil Co. Ltd.
2727 S. Troy Street
Chicago, Illinois

LEISTER, ROBERT G.
Alan Wood Steel Co.
Conshohocken, Pa.

LELAND, HOLLIS L.
Standard Oil Dev. Co.
P. O. Box 243
Elizabeth, New Jersey

LE MAITRE, JULES
Swan-Finch Oil Corp.
RCA Building
New York 20, New York

LEMPERT, FRANK C.
Tide Water Assoc. Oil Co.
1510 Arrott Building
401 Wood Street
Pittsburgh 22, Pennsylvania

LENDWAY, JOSEPH M.
Shell Oil Co.
154 Bagley Ave.
Detroit 26, Mich.

LEON, CLIFFORD E.
Imperial Oil, Ltd.
475 Victoria Avenue, N.
Hamilton, Ontario, Canada

LEONARD, FRANK Q.
Republic Steel Corp.
116th & Burley Avenue
Chicago, Illinois

LEONARD, WILLIAM F.
National Secy. and Treas. (ASLE)
Room 1708 Fisher Building
343 S. Dearborn Street
Chicago 4, Illinois

LE ROY, B. L.
Republic Steel Corp.
Canton, Ohio

LEVALLY, JOHN R.
Lincoln Engineering Co. of Illinois.
2415 South Michigan Avenue
Chicago 16, Illinois

LEVEY, NORMAN J.
Lincoln Engineering Co.
8627 Woodward
Detroit 21, Michigan

LEWIS, JAMES H.
Carnegie, Ill., Steel Corp.
Clairton Works
Clairton, Pa.

LEWIS, RAY D.
Texas Company
3300 Beekman St.
Cincinnati 6, Ohio

LIBERTHSON, LEO
L. Sonneborn Sons. Inc.
88 Lexington Avenue
New York 16, New York

LICHTY, PHILIP H.
Hamilton Watch Co.
Columbia Avenue
Lancaster, Pennsylvania

LIEBERMAN, ARTHUR ARNOLD
Petroleum Marketing Co.
4410 District Blvd.
Los Angeles 11, California

LIEN, ELVIN B.
Union Oil Co. of Cal.
425 First St.
San Francisco, California

LILLIE, JAMES S.
The Pennzoil Co.
942 South Hope
Los Angeles 15, Cal.

LILLMARS, C. ARVID
Petroleum Equipment Co.
3117 North Broad Street
Philadelphia, Pennsylvania

LINDEMANN, E. H.
Minneapolis Honeywell
2753 4th Avenue, S.
Minneapolis, Minnesota

LINDERT, A. W.
Standard Oil Co. of Ind.
Research Dept.
Whiting, Indiana

LINDQUIST, WILLIAM R.
Warren Refining and Chemical Co.
5151 Denison Avenue
Cleveland, Ohio

LINK, G. H.
Shell Oil Co., Inc.
50 W. 50th Street
New York, New York

LINVILL, ALBERT C.
Farval Corp.
327 S. LaSalle Street
Chicago, Illinois

LIVINGSTON, L. P.
Humble Oil & Refining Co.
403 Cotton Exchange Building
Dallas, N. E., Texas

LOCKER, P. H.
Standard Oil Company (N. J.)
Box 66
Linden, New Jersey

LO PRETE, JAMES U.
Alemite Co.
15501 Woodrow Wilson Ave.
Detroit, Michigan

LORENZEN, CHRIST
Shell Oil Co., Inc.
1221 Locust Street
St. Louis, Missouri

LOVENDAHL, ROBERT O.
Aluminum Co. of America
Massena, New York

LOWE, CLYDE L.
Lukens Steel Co.
Coatesville, Pa.

LOWMAN, ALBERT H.
The Texas Co.
111 State St.
Camp Hill, Pennsylvania

LUCAS, FRANK A.
Peacock Bros., Ltd.
510 Federal Building
Toronto, Ontario, Canada

LUNDQUIST, JOSEPH T.
Lincoln Engineering Co. of Ill.
2415 S. Michigan Ave.
Chicago 16, Ill.

LUNZ, GILBERT M.
Lincoln Engineering Co.
2415 S. Michigan Ave.
Chicago 16, Ill.

LYKINS, JOSEPH D.
Wheeling Steel Co.
Yorkville, Ohio

MAAG, O. L.
Timken Roller Bearing Co.
Canton 6, Ohio

MAAS, JOHN B.
Crest Sales & Supply Co., Inc.
1936 W. Lafayette Blvd.
Detroit 16, Mich.

MacBETH, WILLIAM
Standard Oil Co. of Pa.
35th and W. V. R. R.
Pittsburgh, Pennsylvania

MAGILL, F. R.
44 McKnight Street
Pittsburgh 20, Pa.

MAHAFFAY, ROBERT J.
The Chek-Chart Corp.
31 E. Congress Street
Chicago 5, Illinois

MAHNCKE, HENRY E.
Westinghouse Research Lab.
East Pittsburgh, Pennsylvania

MANDY, W. H.
The Texas Co.
No. 31 Terminal Way
Pittsburgh, Pennsylvania

MANLEY, LEO W.
Socony Vacuum Oil Co., Inc.
R & D Labs.
Paulsboro, N. J.

MANTEUFFEL, ALLAN A.
Pure Oil Research & Dev. Labs.
Box 266
Winnetka, Ill.

MARA, JAMES H.
Socony-Vacuum Oil Co., Inc.
4140 Lindell
St. Louis 8, Mo.

MARIS, JOHN H.
L. R. Kerns Co.
5579 Pershing Ave.
St. Louis 12, Missouri

MARKHAM, L. H.
War Department, AAF
Wright Field
Dayton, Ohio

MARLEY, SAMUEL P.
Socony Vacuum Oil Co.
412 Greenpoint Ave.
Brooklyn 22, N. Y.

MARLOW, CHARLES WILLIAM
Standard Oil Co. of N. J.
Route 25
Linden, N. J.

MARSHALL, THOMAS A.
Steel Co. of Canada, Ltd.
Wilcox, Hamilton, Ont., Canada

MARSHALL, W. A.
Alemite Co.
15501 Woodrow Wilson Avenue
Detroit 3, Michigan

MARTIN, JAMES E.
Mid-Continent Petroleum Corp.
Box 60,
Waterloo, Iowa

MARTIN, RALPH V.
Union Oil Co.
Emeryville, Cal.

MATHIS, ERLE W.
Maxoil Mfg. Co.
302 Arthur
Amarillo, Texas

MATTE, GERARD A.
Cities Service Oil Company (Pa.)
70 Pine Street
New York 5, New York

MATTHEWS, RALPH R
Battenfeld Grease & Oil Co.
3148 Roanoke Road
Kansas City 8, Missouri

MAY, EDWIN M.
Bowser, Inc.
420 Lexington Avenue
New York 17, New York

MAYHEW, WILLIAM R.
Luber-Finer, Inc.
2504 S. Grand Avenue
Los Angeles 7, California

McARDLE, F. F.
The Youngstown Sheet & Tube Co.
Brier Hill Works
Youngstown 21, Ohio

McAULIFFE, TED
Bowser, Inc.
1302 E. Creighton Avenue
Fort Wayne, Indiana

McBAIN, WILLIAM C.
The Cold Metal Prod. Co.
45 S. Montgomery Avenue
Youngstown, Ohio

McBRIAN, RAY
Denver Rio Grande West. R.R. Co.
Burnham Shops
Denver 4, Colorado

McCARTHY, G. NORMAN
Texas Company
26 Lansing Street
Buffalo, New York

McCARTHY, WILLIAM A.
Tide Water Assoc. Oil Co.
17 Battery Place
New York, New York

McCASLIN, R. H.
National Refining Co.
1455 Miami Avenue
Toledo, Ohio

McCLELLAN, CHARLES R.
Standard Oil Co. of Cal.
533 Jergins Trust Bldg.
Long Beach 2, California

McCLINTOCK, M. A.
Shell Oil Co.
Box 262
Wood River, Ill.

McCLUNG, ERNEST E.
Van Straaten Chemical Co.
337 West Madison Street
Chicago 6, Illinois

McCONNELL, THOMAS
The Detroit Edison Co.
2000 Second Avenue
Detroit, Michigan

McCORD, ROBERT S.
Douglas Aircraft Co.
Dept. A-852
Santa Monica, California

McCOY, ROSS K.
Lincoln Engineering Co.
2850 Broadway
Oakland 11, California

McCRARY, R. A.
Alemite Co. Eastern Pa.
704 North 16th St.
Philadelphia 30, Pennsylvania

McEWEN, CLIFFORD W.
Peacock Bros. Ltd.
510 Federal Building
85 Richmond Street
Toronto 1, Ontario, Canada

McFADDEN, DAVID B.
Humble Oil & Refining Co.
Box 2180
Houston 1, Texas

McGAR, BENJAMIN H.
Chase Brass & Copper Co., Inc.
236 Grand Street
Waterbury 91, Connecticut

McGINTY, ALFRED L., JR.
Delta Petroleum Co.
P. O. Box 7335
New Orleans 19, Louisiana

McGONIGLE, JOSEPH R.
Humble Oil & Ref. Co.
P. O. Drawer 180
Abilene, Texas

McGROGAN, JOHN F.
Atlantic Refining Co.
3144 Passyunk Avenue
Philadelphia, Pennsylvania

McHENRY, H. J.
Johns Manville
610 Clarke Building
Pittsburgh 22, Pennsylvania

McHENRY, KENNETH E.
Bethlehem Steel Co.
Hamburg Turnpike
Lackawanna, N. Y.

McKAIG, WILLARD H.
International Business Machines
Corp.
Endicott, New York

McKEE, JOHN R.
Fiske Bros. Refining Co.
1500 Oakdale Ave.
Toledo 3, Ohio

McKIBBEN, ROBERT F.
National Cash Register Co.
S. Main and K St.
Dayton 9, Ohio

McKNIGHT, HARRY G., JR.
The Central Petroleum Co.
548 Standard Bldg.
Cleveland 13, Ohio

McLAREN, M. C.
The Texas Co.
Box 509
Beacon, New York

McLENNAN, LESTER W.
Union Oil Co. of Cal.
Oleum, California

McMAHAN, RAYMOND G.
Socony-Vacuum Oil Co.
17 W. Market Street
Indianapolis, Indiana

McMURTRY, ERMIL W.
Sinclair Refining Company
2540 W. Cermak Rd.
Chicago 8, Ill.

McNARY, S. S.
Texas Company
31 Terminal Way
Pittsburgh 19, Pennsylvania

McPHEE, JOHN R.
Ironsides Company
P. O. Box 1999
Columbus, Ohio

MEEK, PAUL F.
Standard Oil Co. (Ohio)
3083 Broadway Ave.
Cleveland 15, Ohio

MENSCH, GEORGE E.
Standard Oil Co. (Ohio)
807 Hartford, S.E.
Canton 1, Ohio

MERCER, MARC E.
Trabon Engineering Corp.
3058 North 75th St.
Milwaukee 10, Wisconsin

MERCHANT, M. E., Dr.
Cincinnati Milling Machine Co.
Research Dept.
Cincinnati 9, Ohio

MERGENTHALER, LLOYD W.
Atlantic Ref. Co.
260 S. Broad St.
Philadelphia, Pa.

MESSINGER, NORMAN A.
The Atlantic Ref. Co.
260 S. Broad St.
Philadelphia 2, Pa.

MEYER, H. C., JR.
Foote Mineral Co.
10 E. Chelten Avenue
Philadelphia 44, Pennsylvania

MEYERS, ROBERT W.
Manzel, Inc.
315 Babcock Street
Buffalo, New York

MICHELL, JAMES S.
Shell Oil Co.
2223 Taylor Street
Fort Wayne, Indiana

MILES, H. V., JR.
Honan-Crane Corp.
409 Indianapolis Avenue
Lebanon, Indiana

MILLER, ARTHUR A.
E. F. Houghton & Co.
3516 S. Shields Ave.
Chicago 9, Ill.

MILLER, GEORGE W.
Battenfeld Grease & Oil Corp.
Box 144
North Tonawanda, New York

MILLER, HARRY L.
Haas-Miller Corp.
4th and Bristol Streets
Philadelphia 40, Pennsylvania

MILLER, LEROY W.
Scott Paper Co.
Chester, Pennsylvania

MILLETT, WILLIAM H.
Linde Air Products Co.
Tonawanda, N. Y.

MINOR, FRANK W.
Sinclair Refining Co.
906 Grand Avenue
Kansas City, Missouri

MITCHELL, CHARLES A.
Van Straaten Chemical Co.
546 W. Washington Blvd.
Chicago, Illinois

MITTEN, J. T.
The Texas Co.
1010 Rand Building
Buffalo, New York

MOHR, EDWARD A.
Shell Oil Company, Inc.
2015 Long Beach Avenue
Los Angeles, California

MOIR, HARRY L.
The Pure Oil Co.
35 E. Wacker Drive
Chicago 1, Illinois

MONINGER, JAMES A.
Standard Oil Co. (Indiana)
715 East 10th Street
Wichita 1, Kansas

MONTZHEIMER, ARTHUR M.
9948 Tujunga Canyon Blvd.
Tujunga, California

MOOK, ARTHUR D.
Aluminum Company of America
Lafayette, Indiana

MOONEY, G. J.
The Texas Co.
P. O. Box 712
Port Arthur, Texas

MOORE, W. R.
Westinghouse Electric Corp.
Box 2025
Buffalo 5, New York

MOREHOUSE, DARRELL V.
St. Croix Paper Co.
Mill Street
Woodland, Maine

MORENS, RALPH MICHAEL
Lincoln Engineering Co.
8627 Woodward Ave.
Detroit 2, Mich.

MORETON, DOUGLAS H.
Douglas Aircraft Company
3000 Ocean Park Boulevard
Santa Monica, California

MORGAN, EUGENE B.
Morgan Oil Co.
Wyaconda, Missouri

MORRELL, NATHAN C.
Camera Works—Eastman Kodak Company
333 State St.
Rochester 4, N. Y.

MORRIS, FRANK G.
American Radiator & Standard Sanitary Corp.
1541 S. 7th Street
Louisville, Kentucky

MORRISON, JOHN E.
Crucible Steel Casting Corp.
2850 S. 20th Street
Milwaukee, Wisconsin

MORRISON, W.
Brooks Oil Co.
336 E. Broadway,
Girard, Ohio

MORTON, H. M.
Garlock Packing Co.
Tippecanoe Road, R. D. No. 2
Canfield, Ohio

MOSEL, VICTOR H.
Trabon Engineering Corp.
528 White Boulevard
Buffalo, New York

MOSIER, K. C.
C. A. Norgren Co.
222 Santa Fe Drive
Denver 9, Colorado

MOSTELLER, JAMES S.
Wright Field, Materials Lab.
Wright Field
Dayton, Ohio

MOULD, ARTHUR E.
Tide Water Associated Oil Co.
1515 Genesee Bldg.
Buffalo, N. Y.

MOUNTCASTLE, HENRY RICHARD
P. O. Box 6327
Pittsburgh 12, Pa.

MOYER, HARRY C., Jr.
The Pure Oil Co.
P. O. Box 515
Marcus Hook, Penn.

MUELLER, CARL H.
Lincoln Engineering Corp.
5701 Natural Bridge Ave.
St. Louis 20, Mo.

MUELLER, JULIUS T.
Falk Corporation
3100 W. Canal St.
Milwaukee, Wis.

MULLEN, HAL G.
Tide Water Assoc. Oil Co.
17 Battery Place
New York 4, New York

MULLER, HENRY
Shell Oil Co., Inc.
50 West 50th St.
New York 20, New York

MULLERWEISS, A. F.
Union Oil Co.
425—1st St.
San Francisco, California

MUNRO, A. L.
Smith Engineering Works
532 E. Capital Drive
Milwaukee 12, Wisconsin

MURPHY, CHARLES M., JR.
Naval Research Lab.
Washington, D. C.

MURPHY, HARRY A.
Gray Co., Inc.
60 - 11 Street N. E.
Minneapolis 13, Minnesota

MURPHY, JOHN J.
Twin Coach Company
Cayuga Road
Cheektonga, N. Y.

MURPHY, WILLIAM P.
Lubri-Zol Corp.
Wickliffe, Ohio

MURRAY, JOHN J.
Alemite Sales Co.
59 E. 25th Street
Chicago, Illinois

MURRAY, J. P.
Dingle-Clark Co.
311 Ross Street
Pittsburgh, Pennsylvania

MURRAY, PETER W.
Colvilles, Ltd.
Technical Offices
Motherwell, Scotland

MYLER, ALAN B.
Sun Oil Co.
1608 Walnut Street
Philadelphia 3, Pennsylvania

NAFF, GUY P.
American Oil Co.
1200 4th Street, S.W.
Washington 4, D. C.

NAGEL, JOHN Q.
Essex Brass Corp.
2000 Franklin Street
Detroit 7, Michigan

NEEDHAM, GEORGE P.
Sun Oil Company
3200 Independence Ave.
Cleveland, Ohio

NEEDS, SYDNEY J.
Kingsbury Mach. Wks., Inc.
4324 Tackawanna Street
Frankford, Philadelphia, Pa.

NEWMAN, THOMAS H. O.
Standard Oil Co. of Brazil
Caixa Postal 970
Rio de Janeiro, Brazil, S. A.

NICHOLS, CLAYTON W., JR.
Socony-Vacuum Oil Co., Inc.
412 Greenpoint Avenue
Brooklyn, New York

NICHOLSON, E. E.
Gulf Ref. Co.
Box 110
Akron, Ohio

NICHOLSON, H. E.
The Texas Co.
3521 E. Michigan Street
Indianapolis 1, Indiana

NICHOLSON, ROSCOE F.
Honan-Crane Corp.
50 Church St.
New York 7, New York

NICOL, ALAN
The Ferro Enamel Corp.
4150 E. 56th Street
Cleveland 5, Ohio

NIEDERLOH, EARL L.
Gray Co., Inc.
60 - 11th Avenue, N. E.
Minneapolis 13, Minnesota

NINOS, NICHOLAS J.
The Texas Co.
Beacon, New York

NOLF, DALE W.
Shell Oil Co., Inc.
1221 Locust Street
St. Louis, Missouri

NORGREN, CARL A.
C. A. Norgren Co.
222 Santa Fe Drive
Denver, Colorado

NORRIS, HENRY LEE
600 West 116th Street
New York 27, New York

NORRIS, WALTER
C. A. Norgren Co.
20 N. Wacker Drive
Chicago 6, Ill.

NORTON, JOHN W.
Union Oil Co. of Calif.
Oleum, California

OBERRIGHT, EDWARD A.
Socony-Vacuum Oil Co.
Research & Devel. Labs.
Paulsboro, N. J.

O'BRIEN, RICHARD H.
Sun Oil Co.
436 Doremus Avenue
Newark, New Jersey

O'CONNOR, JAMES J.
McGraw-Hill Publishing Co.
330 W. 42nd Street
New York 18, New York

O'FARRELL, ROBERT MAURICE
Esso Std. Oil (Caribbean) S. A.
P. O. Box 1198
Ciudad, Trujillo, Dominican Republic

OLDACRE, WILLIAM H.
D. A. Stuart Oil Co.
2727 S. Troy Street
Chicago 23, Illinois

OLIVER, GEORGE W.
Texas Co.
3021 West Third St.
Dayton 7, Ohio

OLSEN, GODTFRED A.
Sunland Refining Co.
P. O. Box 1512
Fresno 16, California

OLSON, PAUL P.
General Petroleum Corp.
710—2nd Ave.
Seattle 4, Washington

OPPENHEIM, ARLIE C.
Firestone Tire & Rubber Co.
Pottstown, Pa.

O'ROURKE, THOMAS J.
American Lubr., Inc.
1575 Clinton Street
Buffalo 6, New York

ORTSTEIN, HERBERT L.
Pacific Mills
Lawrence, Massachusetts

OSTRANDER, HARRY S.
Sun Oil Co., Ltd.
29 Basin St.
Toronto, Ont., Canada

O'SULLIVAN, EUGENE P.
The Texas Co.
332 South Michigan Avenue
Chicago 4, Illinois

OTT, FRANK H.
Union Oil Co. of Calif.
617 W. 7th Street
Los Angeles 14, California

OUSDAHL, ARVILLE R.
Union Oil Co. of Cal.
30 Rockefeller Plaza
New York 20, N. Y.

OVERLOCK, R. P.
The Pure Oil Co.
420 Lexington
New York, N. Y.

OVERSTREET, H. A.
Richfield Oil Corp.
166 Wisconsin Ave.
San Francisco, California

OWENS, IRWIN E.
Sun Oil Co.
1608 Walnut Street
Philadelphia 3, Pennsylvania

OWINGS, KENNETH B.
Tide Water Associated Oil Co.
17 Battery Place
New York 4, New York

PAAPE, LAWRENCE F.
Filmite Oil Corp.
Station K
Milwaukee, Wisconsin

PALMER, CHARLES
Morgan Construction Co.
15 Belmont Street
Worcester 5, Massachusetts

PALMER, FRANCIS F.
Sun Oil Co.
760 Brooks Ave.
Rochester, N. Y.

PALMER, JOHN F., JR.
Monsanto Chem. Co.
1700 S. Second St.
St. Louis 4, Mo.

PARCHE, WILLIAM HENRY
Carborundum Company
P. O. Box 337
Niagara Falls, New York

PARKS, CHARLES H.
The Bullard Co.
286 Canfield Avenue
Bridgeport 2, Connecticut

PATE, A. M. JR.
Panther Oil & Grease Mfg. Co.
P. O. Box 711
Fort Worth 1, Texas

PATEK, JOHN M.
Eastman Kodak Co.
343 State Street
Rochester 4, New York

PAUL, ALFRED A.
Brooks Oil Co.
4804 W. Chicago Ave.
Chicago 51, Ill.

PAYNE, P. S.
Richfield Oil Corp.
333 Montgomery St.
San Francisco, California

PEARCE, EDWIN S.
Railway Service & Supply Corp.
510 S. Harding Street
Indianapolis 7, Indiana

PEARSON, FRANCIS H.
Richfield Oil Corp.
333 Montgomery St.
San Francisco, California

PEEPLES, HOWARD T.
Timken Roller Bearing Co.
1835 Dueber Ave., S. W.
Canton 6, Ohio

PEIRSON, EUGENE L.
National Cash Reg. Co.
Main & K Sts.
Dayton 9, Ohio

PELLETIER, PAUL E., JR.
Chemco Prod. Co., Inc.
1059 E. 76th Street
Chicago 19, Illinois

PENDLETON, JOHN H.
Talon, Inc.
626 Arch St.
Meadville, Pa.

PENFOLD, NORMAN C.
Armour Research Foundation
35 West 33rd Street
Chicago 16, Illinois

PENN, JOHN J.
Crane Co.
4100 Kedzie Avenue S.
Chicago 5, Illinois

PENNOCK, WILLIAM T.
Alemite Sales Co., Inc.
59 East 25th St.
Chicago 16, Ill.

PERINE, RAYMOND R., JR.
Gulf Ref. Co.
1080 Kansas St.
Memphis, Tenn.

PERKINS, EDWARD A.
Alemite Co. of Buffalo, Inc.
26 Goodrich St.
Buffalo 3, N. Y.

PERKINS, HORACE P.
1320 W. North Road
Bethlehem, Pennsylvania

PERRIGUEY, WILBUR G.
Standard Oil Co. (New Jersey)
26 Broadway Ave.
New York, N. Y.

PERSO, ERWIN E.
The Texas Co.
2211 E. Washington St.
Los Angeles 21, Cal.

PETERSON, CARL G.
Falk Corp.
3001 W. Canal St.
Milwaukee, Wis.

PETERSON, J. WILLARD
Standard Oil Co. (Ind.)
910 South Michigan Avenue
Chicago, Illinois

PETHYBRIDGE, CHARLES A.
New Britain Mach. Co.
Cedar Hill
New Britain, Connecticut

PEUCHEN, WALTER G.
Houde Engineering Division
537 E. Delavan Ave.
Buffalo 11, N. Y.

PEW, J. S.
Sun Oil Co.
Grant Bldg.
Pittsburgh 17, Pa.

PFAFF, EDWIN I.
Trabon Engineering Corp.
1814 East 40th Street
Cleveland 3, Ohio

PHELPS, BENJAMIN B.
Honan-Crane Corp.
2843 E. Grand Boulevard
Detroit 11, Michigan

PHILIP, RUSSEL E.
Hamilton Watch Co.
Columbia Avenue
Lancaster, Pennsylvania

PHILLIPS, KENNETH
5153 Hillcrest Street
Pittsburgh 24, Pennsylvania

PICRAUX, T. V.
Lincoln Engineering Co.
5703 Natural Bridge Ave.
St. Louis, Mo.

PIPES, GAYLE W.
MFA Oil Co.
Columbia, Mo.

PIRKLE, MORGAN W.
Faber Laboratories of New York
51-57 Franklin Street
New York 13, New York

PITT, CHARLES B.
Sun Oil Co., Ltd.
29 Basin St.
Toronto, Ont., Canada

POBST, FRANK M.
The Texas Co.
3521 E. Michigan Street
Indianapolis, Indiana

POGMORE, ARTHUR G.
Purolator Prod., Inc.
744 Broad Street
Newark 2, N. J.

POLICK, JOHN W.
Shell Oil Co., Inc.
523 Grant Bldg.
Pittsburgh, Pennsylvania

POOLE, E. C.
Cities Service Oil Co.
P. O. Box 479
Indianapolis, Indiana

POPE, CHARLES L.
Eastman Kodak Co.
Kodak Park
Rochester 4, New York

POPSON, S. F.
Gulf Refining Co.
1901 South 7th Street
Louisville 1, Kentucky

POST, EVERETT C.
Tide Water Assoc. Oil Co.
East 22nd St.
Bayonne, New Jersey

POSTELNEK, WILLIAM
L. R. Kerns Co.
2657 East 95th St.
Chicago, Illinois

POTTER, RAYMOND I.
Standard Oil Co. (Ohio)
1784 Midland Building
Cleveland, Ohio

POWELL, JAMES B.
Phillips Petroleum Co.
3rd and Polk
Amarillo, Texas

POWERS, S. L.
S. L. Powers Equipment Co.
7016 Euclid Ave.
Cleveland 3, Ohio

PRENDERGAST, WILLIAM A.
The Texas Co.
P. O. Box 509
Beacon, N. Y.

PRESTON, JOHN H.
Sinclair Ref. Co.
630 Fifth Ave.
New York 20, New York

PRICE, DANIEL J.
Inland Steel Co.
Indiana Harbor, Ind.

PRICE, DON C.
Bowser, Inc.
18247 Livernois Ave.
Detroit 21, Mich.

PRICE, HARRIE B., JR.
Sun Oil Co.
1608 Walnut St.
Philadelphia 3, Pa.

PRITCHARD, CHARLES E.
Republic Steel Corp.
25 Prospect Street
Cleveland 1, Ohio

RABA, JOSEPH B.
W. H. Barber Co.
3650 S. Homan Ave.
Chicago, Ill.

RADOSEVICH, GEORGE E.
Harnischfeger Corp.
4400 W. National Ave.
Milwaukee 14, Wis.

RAFFEL, FRANK H.
Republic Steel Corp.
Harvard Ave.
Cleveland 9, Ohio

RAGEE, JOSEPH I.
Caterpillar Tractor Co.
Peoria, Illinois

RAHM, A. E.
War Dept., AAF Wright Field
Dayton, Ohio

RAMP, W. F., SR.
Alemite Co. of the Northwest
424 N. W. 14th Ave.
Portland 9, Oregon

RANDAK, ARTHUR S.
Sinclair Refining Co.
630 Fifth Avenue
New York 20, New York

RANDALL, CLARK C.
Sinclair Refining Co.
2540 W. Cermak Road
Chicago 8, Illinois

RANDALL, MERLE
Randall and Sons
2512 Etna St.
Berkeley 4, California

RANEY, J. H.
The Texas Co.
31 Terminal Way
Pittsburgh, Pa.

RAU, HARRY, JR.
Crown Cork & Seal Co., Inc.
Eastern Ave. and Kresson St.
Baltimore 24, Maryland

RAWLINGS, J. F.
Greyhound Cab
4213 Reisterstown Road
Baltimore 15, Maryland

REAGAN, J. E.
Elco Lubricant Corp.
Jennings Rd. and Dennison Ave.
Cleveland 9, Ohio

REAGAN, MAURICE E., JR.
Somers, Fitler & Todd
327 Water Street
Pittsburgh, Pennsylvania

RECINE, PROF. DOTT. ING. ARNALDO G.
Via S. Guiliano
Genoa, Italy

REDD, C. H.
Lincoln Engineering Co.
421 E. Washington Street
Los Angeles 15, California

REEDER, RALPH L.
Alliance Mfg. Co.
Alliance, Ohio

REGAN, ROBERT W.
Sun Oil Co.
310 S. Michigan Avenue
Chicago 4, Illinois

REED, KENNETH D.
The De Laval Separator Co.
165 Broadway
New York 6, New York

REICHNER, FREDERIC F., JR.
Procter & Schwartz
7th Street and Tabor Road
Philadelphia 20, Pennsylvania

REILLY, C. TYSON
Standard Oil Co. of Pa.
Conners Crossing
Schuylkill Haven, Pa.

REINSBURROW, JAMES
MacKenzie Muffler
Merdian Road
Youngstown, Ohio

REISSIG, A. RICHARD
Socony-Vacuum Oil Co., Inc.
Church St.
Albany 1, New York

RENNO, ARTHUR A.
The Texas Company
31st and Grays Ferry Ave.
Philadelphia 46, Pennsylvania

REPENNING, ROBERT F.
Shell Oil Co., Inc.
624 S. Michigan Ave.
Chicago 5, Illinois

RESWICK, MAURICE
Standard Oil Co. (N. J.)
30 Rockefeller Plaza
New York 20, New York

RETTIG, MARION H.
Bowser, Inc.
E. Creighton Avenue
Ft. Wayne 5, Indiana

REYNOLDS, DARRELL R.
Honan-Crane Corp.
Box 241
Churubusco, Indiana

REYNOLDS, E. S.
Socony-Vacuum Oil Co., Inc.
Robb St. and Ohio River
McKees Rocks, Pa.

REYNOLDS, HARRY M.
Renite Co.
420 E. Fifth Ave.
Columbus, Ohio

REYNOLDS, M. W.
Acheson Colloids Corp.
Washington Avenue
Port Huron, Michigan

REYNOLDS, WILLIAM H.
Socony-Vacuum Oil Co., Inc.
4140 Lindell St.
St. Louis 8, Mo.

RHODE, GRANT M., JR.
D-A Lubricant Co., Inc.
1311 W. 29th
Indianapolis 8, Indiana

RICE, CHARLES M.
Shell Oil Co. of Canada, Ltd.
43 King William Street
Hamilton, Ontario, Canada

RICHARDS, DONALD L.
Carlisle Chemical Works
4040 N. Kedzie Ave.
Chicago, Ill.

RICHARDS, JAMES H.
E. F. Houghton & Co.
822 Plymouth Bldg.
Minneapolis 2, Minnesota

RICHARDS, JOHN H., Jr.
Apex Alkali Prod. Co.
Main and Rector Streets
Philadelphia 27, Pennsylvania

RICHARDSON, PAUL T.
The Willis Lubr. Corp.
3333 Sunset Boulevard
Steubenville, Ohio

RIGBY, JOSEPH A.
The Brooks Oil Co.
934 Ridge Avenue
Pittsburgh 12, Pennsylvania

RIGG, D. D.
Sinclair Ref. Co.
135 South 56th St.
Philadelphia, Pennsylvania

RINEARSON, R. O.
The Warren Refining and Chemical Co.
5151 Denison Avenue
Cleveland 2, Ohio

RISS, OTTO J.
Cleveland Graphite Bronze Co.
17000 St. Clair Avenue
Cleveland 10, Ohio

RITCHIE, GORDON O.
Shell-Mex & B. P., Ltd.
Shell-Mex House, Strand
London, England

RITCHIE, JOHN R., JR.
Ritchie Engineering Co.
3509 Irving Avenue, S.
Minneapolis 8, Minnesota

RITTER, WAYNE G.
Trabon Engineering Corp.
44 McKnight Street
Pittsburgh 20, Pennsylvania

ROARK, GEORGE V.
The Texas Co.
929 S. Broadway
Los Angeles 15, California

ROBB, ROBERT T.
Lincoln Engineering Co.
2028 E. 46th Street
Cleveland 3, Ohio

ROBERT, F. C.
Gulf Oil Corp.
Gross and P. R. R.
Pittsburgh, Pennsylvania

ROBERTSON, B. P.
Humble Oil & Ref. Co.
P. O. Box 2180
Houston 1, Texas

ROBERTSON, EARL D.
The Texas Co.
2414 De Kalb Street
St. Louis 4, Missouri

ROBINSON, WILLIAM E.
Barrett Div.
36th & Grays Ferry
Philadelphia, Pennsylvania

ROBISON, ROBERT V.
Dingle-Clark Co.
311 Ross Street
Pittsburgh, Pennsylvania

ROBSON, ERNEST S., JR.
Monsanto Chem. Co.
1700 South 2nd St.
St. Louis 4, Missouri

ROBSON, N. STEWART
F. D. Johnson Co.
1814 E. 40th Street
Cleveland, Ohio

ROEDER, CARL O.
Farval Corp.
3277 East 80th St.
Cleveland 4, Ohio

ROEHNER, T. G.
Socony-Vacuum Oil Co.
412 Greenpoint Ave.
Brooklyn 22, N. Y.

ROOSA, HERBERT H.
Manzel, Inc.
315 Babcock St.
Buffalo 10, New York

ROSENSTIEHL, FRED E.
The Texas Co.
135 East 42nd Street
New York 17, New York

ROSNELL, JOHN E.
Texas Co.
322 S. Michigan Ave.
Chicago 4, Illinois

ROSS, EDGAR S.
Sun Oil Co.
1608 Walnut Street
Philadelphia 3, Pennsylvania

ROSS, F. R.
Alemite Co. of Pittsburgh
201 Shady Ave.
Pittsburgh, Pa.

ROSS, FRANK
E. F. Houghton & Co.
4500 Euclid Ave.
Cleveland 3, Ohio

ROSSTEAD, OLIVER B., JR.
American Oil Co.
1301 Grant Bldg.
Pittsburgh 19, Pennsylvania

ROTHSTEIN, ISIDORE A.
Central Testing Lab.
480 Canal St.
New York 13, New York

ROTS, PETER L.
Keystone Lub. Co.
327 Water Street
Pittsburgh, Pennsylvania

ROUGELOT, RODNEY B.
Gulf Refining Co.
1200 E. Main Street
Chattanooga, Tennessee

ROUNDS, THOMAS E., JR.
The Barden Co.
E. Franklin St.
Danbury, Connecticut

ROWE, JAMES J.
Cities Service Oil Co.
70 Pine St.
New York, N. Y.

ROY, RICHARD F.
Cleveland Graphite Bronze Co.
17000 St. Clair Avenue
Cleveland 10, Ohio

RUEDRICH, PAUL M.
Griffin Chemical Co.
1000 16th Street
San Francisco 7, California

RUFFNER, ARTHUR F.
Metal Working Lub., Inc.
417 Penton Building
Cleveland 13, Ohio

RUMBERGER, WILLIAM M.
Titan Metal Mfg. Co.
Bellefonte, Pa.

RUPERT, JOHN F.
Lincoln Engineering Co.
2850 Broadway
Oakland 11, California

RUPP, JOHN C.
Colonial Beacon Oil Co.
320 Freeman St.
Brooklyn 22, N. Y.

RUSSELL, THOMAS W.
General Petroleum Corp.
2423 E. 28th Street
Los Angeles 11, California

RUTMAN, GEORGE J.
Sta-Vis Oil Co.
184 Eagle Street
St. Paul, Minnesota

RYAN, CHARLES A.
Alemite Sales Co.
59 E. 25th Street
Chicago, Illinois

RYAN, TRUXTON B.
Dingle-Clark Co.
1617 Pennsylvania Blvd.
Philadelphia 3, Pennsylvania

RYAN, VICTOR A.
Crown Cork & Seal Co., Inc.
Eastern Ave. & Kresson St.
Baltimore 3, Maryland

SADLER, STAFFORD C.
General Petroleum Corp. of Calif.
2423 E. 28th Street
Los Angeles 11, Calif.

SAGER, ROBERT C.
Gulf Oil Corp.
1070 Niagara Street
Buffalo, New York

SAILER, ROMAN L.
Valvoline Oil Co.
318 Atlantic Ave.
Franklin, Pennsylvania

SALB, FRANCIS E.
G. M. Co., Allison's Div.
Maywood, Indiana

SALISBURY, GLEN D.
The Phoenix Oil Co.
6432 Cass
Detroit 2, Mich.

SALZBERG, LEO F.
Air Materiel Command, AAF
Materials Lab., Beam 2
Wright Field, Ohio

SANDERS, IRVIN W.
Sun Oil Co.
1910 Russell Street
Baltimore 30, Maryland

SARGENT, F. J.
The National Refining Co.
Hanna Building
Cleveland 15, Ohio

SAUERBRUN, WILLARD E.
Sinclair Ref. Co.
10 West 51st St.
New York 20, New York

SAWIN, GEORGE R., JR.
Shell Oil Co., Inc.
54 Riverside Avenue
Rensselaer, New York

SAWYER, DAVID W.
Aluminum Research Labs.
Aluminum Co. of America
Freeport Rd.
New Kensington, Pennsylvania

SCEATS, H. B.
McColl-Frontenac Oil Co.
1355 Burlington St., E.
Hamilton, Ont., Canada

SCHAEFFER, CHARLES M.
Bethlehem Steel Co.
East 3rd Street
Bethlehem, Pennsylvania

SCHAFER, H. W.
D. A. Stuart Oil Co.
2727 S. Troy Ave.
Chicago, Illinois

SCHEIDELL, JOHN
Sun Oil Co.
1608 Walnut St.
Philadelphia 3, Pennsylvania

SCHELL, NOBLE H.
International Harvester Co.
Fort Wayne Works
Pontiac & Bueter Road
Ft. Wayne, Indiana

SCHENCK, Rand G., Sr.
Fiske Brothers Refining Co.
614 Ridgefield Avenue
Pittsburgh 16, Pennsylvania

SCHENKE, KURTISS P.
Application Co.
205 East 42nd St.
New York 17, New York

SCHLEICHER, ROWELL A.
Black Bear Company, Inc.
44-45 23rd Street
Long Island City 1, New York

SCHMID, A. A.
Allison Div., G.M.C.
Indianapolis, Indiana

SCHMITT, C. R.
E. F. Houghton and Co.
4500 Euclid Avenue
Cleveland 3, Ohio

SCHMITT, J. R.
Standard Oil Co. of Cal.
605 W. Olympic Blvd.
Los Angeles 54, California

SCHMITZ, CARL E.
Crane Packing Co.
1800 Cuyler Ave.
Chicago 13, Illinois

SCHNEIDER, E. A.
Socony Vacuum Oil Co., Inc.
907 S. First Ave.
Milwaukee, Wisconsin

SCHOTT, JOHN E.
Socony Vacuum Oil Co., Inc.
412 Greenpoint Ave.
Brooklyn 22, New York

SCHROEDER, ELMER R.
Alemite Co. of Wis., Inc.
1010 N. Van Buren Street
Milwaukee 2, Wisconsin

SCHUCK, WILLIAM M.
Armco Steel Corp.
General Office
Middletown, Ohio

SCHWABE, HERMAN
Nathan Mfg. Co.
416 East 106th St.
New York 29, New York

SCOBIE, JAMES A., JR.
American Oil Co.
American Bldg.
Baltimore, Md.

SCOTT, CHARLES RALLYA
Wolf's Head Oil Ref. Co.
Fair Building
Oil City, Pennsylvania

SCOTT, GEORGE E.
Lincoln Engineering Co.
5701 Natural Bridge
St. Louis, Missouri

SCOTT, JAMES J.
Bound Brook Oil-less Bear. Co.
Bound Brook, New Jersey

SEALY, FRED J.
Hodson Corp.
5301 West 66th Street
Chicago 38, Illinois

SEINER, MILTON
General Electric Co.
6901 Elmwood Avenue
Philadelphia 42, Pennsylvania

SELLEI-BERETVAS, DR. HELEN
Standard Oil Co. of Ind.
Standard Oil Labs.
Whiting, Indiana

SELLERS, H. L.
Shell Oil Co., Inc.
700 N. Euclid Ave.
Dayton 7, Ohio

SEMLER, GEORGE W.
Standard Oil Co. of Pa.
35th and A. V. R. R.
Pittsburgh, Pennsylvania

SENIFF, RUSSELL W.
Baltimore & Ohio R. R. Co.
Pratt & Arlington Sts.
Baltimore, Md.

SENTNER, WILLIAM F.
Acheson Colloids Corp.
102 Pearl Street
Boston 10, Massachusetts

SERVICE, MURRAY G.
Waverly Oil Works Co.
54th St.
Pittsburgh 1, Pa.

SETTLE, S. W.
Sun Oil Co.
3200 Independence Road
Cleveland, Ohio

SETZER, AUBREY
Colgate Palmolive Peet Co.
105 Hudson St.
Jersey City 2, New Jersey

SEWARD, WILLIAM H.
Shell Oil Co., Inc.
208 E. Carv Street
Richmond, Virginia

SHAFFER, T. F.
Shell Oil Co., Inc.
2012 West 25th St.
Cleveland, Ohio

SHANKS, CARL
Panther Oil & Grease Mfg. Co.
840 N. Main Street
Fort Worth 1, Texas

SHANNON, JAMES G., JR.
The Texas Co.
6707 Dix
Detroit 11, Michigan

SHANNON, THOMAS P.
D. A. Stuart Oil Co.
2727 S. Troy Street
Chicago, Illinois

SHARPE, ROBERT Q.
Socony Vacuum Oil Co.
26 Broadway
New York, N. Y.

SHAWK, HARRY A.
Tide Water Associated Oil Co.
79 New Montgomery
San Francisco 20, California

SHEARMAN, SPICER D.
Aro Equipment Corp.
Bryan, Ohio

SHELDON, E. R.
Socony-Vacuum Oil Co.
130 Pearl Street
Buffalo, New York

SHERMAN, THOMAS L.
Fairbanks, Morse & Co.
Beloit, Wisc.

SHOEMAKER, R. S.
The Brooks Oil Co.
No. 1 Alameda Circle
Middletown, Ohio

SHORT, HOWARD E.
Cincinnati Milling Machine Co.
Marburg Avenue
Cincinnati 9, Ohio

SHUGART, J. W., JR.
Southwestern Petr. Co., Inc.
917 N. Main St.
Fort Worth, Texas

SHULTZ, CLAUDE L.
Van Straaten Chemical Company
337 W Madison St.
Chicago 6, Illinois

SICKELER, OLEN D.
Spang Chalfant Co.
Duss Avenue
Ambridge, Pennsylvania

SIEBER, WILLIAM T.
Waverly Oil Works Co.
54th St. and A. V. R. R.
Pittsburgh, Pennsylvania

SIEFERS, H. KENNETH
United Oil Company
1800 N. Franklin Street
Pittsburgh 12, Pennsylvania

SIMMINGER, K. EDWARD
Bowser, Inc.
521 Arch St.
Philadelphia, Pa.

SIMON, JOHN
713 Wiley Avenue
McKeesport, Pennsylvania

SINNOTT, V. P.
Alemite Co.
26 Goodridge Street
Buffalo, New York

SIROTKIN, GEORGE V. B.
Kearney & Trecker Corp.
6784 W. National
West Allis, Wis.

SITES, JAMES W.
The Ohio Oil Co.
Maumee Road
Ft. Wayne, Indiana

SIZER, JOHN A., JR.
Ehret & Kinsey
327 S. LaSalle St.
Chicago, Illinois

SKELLY, JAMES J.
Circo Products Co.
12117 Berea Rd.
Cleveland 11, Ohio

SKOOGLUND, ARTHUR C.
Esso Standard Oil Co.
15 W. 51st Street
New York 19, New York

SKYRUS, JOSEPH P.
Van Straaten Chemical Company
337 W. Madison St.
Chicago 3, Illinois

SLAVIN, ERNEST F.
Bee Bee Shoe Co.
Manchester, New Hampshire

SLOMER, JOS. J.
Goodman Mfg. Co.
49th and Halsted St.
Chicago 9, Illinois

SMALLEY, B. L.
L. R. Kerns Co.
2657 East 95th St.
Chicago, Illinois

SMITH, R. ARMAND
Sinclair Refining Co.
P. O. Box 1366
Knoxville 1, Tennessee

SMITH, B. H.
Texas Div. Dow Chem. Co.
Freeport, Texas

SMITH, FRANCIS G.
American Oil Co.
1307 N. Front Street
Harrisburg, Pennsylvania

SMITH, GEORGE L.
C. H. Clark Oil Co.
2625 East 76th St.
Cleveland 4, Ohio

SMITH, GORDON D.
Canadian Oil Companies, Ltd.
Burlington Street
Hamilton, Ontario, Canada

SMITH, HAMILTON W.
Golden Bear Oil Co.
325 W. Eighth St.
Los Angeles 14, California

SMITH, JULIUS C.
Standard Oil Co. of California
225 Bush Street
San Francisco, California

SMITH, LAWRENCE H.
Gulf Oil Corp.
3800 Gulf Bldg.
Pittsburgh, Pa.

SMITH, MELVIN I.
Socony Vacuum Oil Co.
412 Greenpoint Ave.
Brooklyn 22, New York

SMITH, PARKER B.
Socony Vacuum Oil Co.
59 East Van Buren Street
Chicago 5, Illinois

SMITH, RICHARD C.
Gulf Oil Corp.
755 Brooks Avenue
Rochester, New York

SMITH, ROBERT O
Alemite Company
15501 Woodrow Wilson Avenue
Detroit, Michigan

SMITH, VICTOR W.
G. W. Smith & Sons, Inc.
5400 Kemp Road
Dayton 3, Ohio

SMITH, WILLIAM H.
Fiske Brothers Refining Co.
P. B. 1526 Central Station
Toledo, Ohio

SNYDER, CHARLES H.
National Ref. Co.
125 Elinor Ave.
Akron 9, Ohio

SOLLITT, C. ALEX
Campbell Lubricating Specialties
414 Eastern Avenue
Toronto, Ontario, Canada

SOLOVEY, IRA L., CAPT.
U. S. Air Forces
HQ. AMC, Box 644
Wright Field
Dayton, Ohio

SOMERVELL, S. Bruce
Application Co.
205 E. 42nd St.
New York 17, New York

SOPHER, W. M.
Union Oil Co. of Calif.
617 W. 7th Street
Los Angeles, Calif.

SOREM, STANLEY S.
Shell Development Co.
4560 Horton Street
Emeryville, California

SOROKA, SERGE J.
Esso Standard Oil Co. of Pa.
35th and A.V.R.R.
Pittsburgh, Pennsylvania

SOUTHARD, C. M.
Ohio Oil Co.
Findlay, Ohio

SOUTHCOTT, ARNOLD M.
Otis Elevator Co.
260 11th Avenue
New York 1 New York

SOWERS, W. S.
Quaker State Oil Ref. Corp.
1st and Clay Streets
Martins Ferry, Ohio

SPARKS, STANLEY E.
Viscosity Oil Co.
3820 W. Pershing Rd.
Chicago, Illinois

SPERLING, MILTON H.
Richfield Oil Corp.
555 S. Flower Street
Los Angeles, California

SPICE, B. G.
Alox Corporation
510 N. Dearborn Street
Chicago 10, Illinois

SPOONER, FREDERICK W.
Shell Oil Co.
50 W. 50th Street
New York, New York

STACK, JOHN W.
Standard Oil Co. (Ind.)
910 South Michigan Avenue
Chicago 80, Illinois

STAGER, LEONARD A.
Fiske Bros. Refining Co.
P. O. Box 38—Sta. A
Toledo 5, Ohio

STAINES, P. RAYMOND
The Davison Chemical Corp.
Curtis Bay Plant
Baltimore 3, Maryland

STAMM, JOHN C.
Sunland Refining Corp.
P. O. Box 1512
Fresno, California

STANICH, V. M.
General Petroleum Corp.
2525 East 37th Street
Vernon, California

STARK, WM. WELDON, JR.
LT. COMMANDER
Caltex (India) Ltd.
New Delhi, India

STATES, RONALD R.
N. Y. & N. J. Lubricant Co.
530 William Penn Place
Pittsburgh, Pennsylvania

STEELE, ARLO L.
Robbins & Myers, Inc.
1345 Lagonda
Springfield, Ohio

STEELE, FINLEY M.
The Hilliard Corp.
102 W. 4th Street
Elmira, New York

STEELE, VARIAN
Industrial Brg. Corp.
1466 Main Street
Buffalo 9, New York

STEINBERGER, JOHN J.
Robbins & Myers, Inc.
Springfield, Ohio

STEVENS, ROY H.
Chek-Chart Corp.
31 E. Congress Street
Chicago 5, Illinois

STEVENSON, WM. E., JR.
Stevenson Oil & Chem. Co.
986 East 200
Cleveland 19, Ohio

STILWELL, WILLIAM MOORE, JR.
Dingle-Clark Co.
1617 Pennsylvania Blvd.
Philadelphia 3, Pennsylvania

STINE, JAMES E.
Sun Oil Company
420 Lexington Avenue
New York 17, New York

STINSON, PHILIP M.
2621 Virginia Park
Detroit 6, Michigan

STOCKWELL, FRED E.
Esso Standard Oil Co.
P. O. Box 90
Hartford, Connecticut

STOEHR, ALFRED F.
Cities Service Oil Co.
1320 Macklind
St. Louis 10, Missouri

STOKELY, JOHN M.
California Res. Corp.
576 Standard Ave.
Richmond, California

STOLTZ, EDWARD, JR.
Johns-Manville Sales Corp.
1312 Standard Oil Building
Baltimore 2, Maryland

STOLTZ, MARTIN J.
Purolator Products, Inc.
744 Broad Street
Newark 2, New Jersey

STONEROD, THOMAS M.
The Books Oil Co.
315 E. Carson Street
Pittsburgh 19, Pennsylvania

STORER, WILLIAM
Lukens Steel Co.
Coatesville, Pennsylvania

STRANAHAN, L. H.
White Motor Co.
842 East 79th Street
Cleveland 1, Ohio

STRINGER, H. G.
Shell Oil Co.
154 Bagley
Detroit, Mich.

STRINGER, WINSLOW J., JR.
Sun Oil Co.
1225 Seaview Avenue
Bridgeport 1, Connecticut

STROHECKER, ROBERT F.
The Texas Co.
Beacon, N. Y.

STROHMAIER, ALFRED J:
E. I. duPont deNemours & Co.
1007 Market Street
Wilmington 98, Delaware

STUART, CARL B.
Shell Oil Company
49 Worthington Avenue
Youngstown, Ohio

STURGIS, DR. BERNARD M.
E. I. du Pont de Nemours & Co.
Jackson Laboratory
Wilmington, Delaware

STUTSON, A. C.
Socony-Vacuum Oil Co., Inc.
26 Broadway
New York, N. Y.

SUHRE, A. B.
National Refining Co.
1600 Clark Avenue
St. Louis, Missouri

SUMNER, GEORGE L.
Westinghouse Elec. & Mfg. Co.
East Pittsburgh, Pennsylvania

SUMNER, GEORGE LEWIS, JR.
Gulf Research and Dev. Co.
P. O. Box 2038
Pittsburgh 30, Pennsylvania

SUNDHEIMER, WALTER
Shell Oil Co., Inc.
5831 York Rd.
Baltimore 12, Maryland

SUTTON, WILLIAM K.
Standard Oil Co. of N. J.
15 W. 51st Street
New York, New York

SVENSON, E. B.
Aluminum Company of America
New Kensington, Pennsylvania

SWAIN, JOHN W., JR.
Mergraf Oil Prod. Co., Inc.
P. O. Box 95
Northville, Michigan

SWEATT, CHARLES H.
Linde Air Products Co.
E. Park Drive and Woodward
Tonawanda, New York

SWYGARD, A. C.
Aro Equipment Corp.
Bryan, Ohio

SYMON, B. G.
Shell Oil Co., Inc.
50 West 50th Street
New York 20, New York

TACHOIR, LEO
Tide Water Assoc. Oil Co.
1510 Arrott Bldg.
Pittsburgh 22, Pennsylvania

TALLEY, S. K.
Shell Development Co.
4560 Horton Street
Emeryville 8, California

TATTON, ZALA C.
Caltex Oil
(Australia) Pty., Ltd.
62 Margaret Street
Sidney, Australia

TAYLOR, ARTHUR J.
Johns Manville Corp.
Manville, New Jersey

TAYLOR, J. I. CHARLES
Sun Oil Co.
Grant Bldg.
Pittsburgh 19, Pennsylvania

TAYLOR, O. J.
Gulf Oil Corp.
Cross St. & P. R. R.
Pittsburgh, Pennsylvania

TAYLOR, WILLIAM C.
Sun Oil Co.
1608 Walnut Street
Philadelphia 3, Pennsylvania

TAYLOR, WILLIAM L.
Electrical Mach. & Supply Co.
144 Third Ave., N.
Nashville 3, Tennessee

TEAGUE, WALTER E.
Richfield Oil Corp.
1835 E. Washington
Los Angeles 21, California

TEAL, PERCY P
Alemite Co. of Eastern Penna.
704 North 16th St.
Philadelphia, Pennsylvania

TERRELL, HOWELL H.
Sinclair Refining Co.
P. O. Box 131
Lakeland, Florida

TERWILLIGER, M. S.
Shell Oil Co., Inc.
12 S. 12th Street
Philadelphia 20, Pennsylvania

THARP, LEWIS R.
E. F. Houghton & Co.
P. O. Box 1806, Cabanne Station
St. Louis 12, Mo.

THARP, RAY L.
O. L. King & Co.
436 Clementina
San Francisco, California .

THAYER, C. D.
Socony-Vacuum Oil Co.
412 Greenpoint Ave.
Brooklyn 22, New York

THILOW, FRANK B.
American Oil Co.
34th & Gray's Ferry Avenue
Philadelphia 46, Pennsylvania

THOMAS, O. J.
Lincoln Engineering Co.
1439 S. W. 6th Avenue
Portland 1, Oregon

THOMAS, JOHN P.
Shell Oil Co., Inc.
624 S. Michigan Boulevard
Chicago 5, Illinois

THORBURN, ARTHUR F.
Shell Oil Co. of Canada, Ltd.
43 King William Street
Hamilton, Ontario, Canada

THORKELSON, R. H.
Dingle-Clark Co.
1248 Engineers Building
Cleveland 14, Ohio

THUREN, ARTHUR I.
Swan-Finch Oil Corp.
201 N. Wells St.
Chicago 6, Illinois

TICHVINSKY, LEONID M.
University of California
Berkeley 4, California

TIERNAN, JAMES B.
Lubriplate Div. of Fiske Bros.
Refining Co.
129 Lockwood St.
Newark 5, New Jersey

TINSLEY, ROE F.
Gulf Oil Corp.
17 Battery Place
New York, N. Y.

TISDALL, TREVOR H.
Colonial Beacon Oil Co.
50 Rockefeller Plaza
New York, New York.

TORRENS, ROBERT J.
Eastman Kodak Co.
Kodak Park
Rochester, New York

TOWNSEND, F. LEE
Wm. W. Nugent & Co.
410 N. Hermitage Ave.
Chicago 22, Ill.

TOWNSEND, F. LEN
E. F. Houghton & Co.
3516 S. Shields Ave.
Chicago 9, Illinois

TRACEY, JOHN
Cities Service Oil Co.
70 Pine Street
New York, New York

TRAVERS, HOWARD F.
The Travelon Oil Co.
P. O. Box 7
Rochester 1, New York

TREFFEISEN, G.
Alemite Division of
Stewart-Warner Co.
1826 W. Diversey Parkway
Chicago 14, Illinois

TREWIN, F. HOWARD
Socony-Vacuum Oil Co.
10 Light Street
Baltimore 2, Maryland

TREXLER, JAY
Shell Oil Company, Inc.
1001 St. Paul St.
Baltimore 2, Maryland

TUCHBAND, ROBERT E.
Cities Service Oil Co.
3200 S. Western Avenue
Chicago, Illinois

TURNAU, EDMUND H.
Shell Oil Co., Inc.
1066 Madison Avenue
Albany 3, New York

TURNER, A. H.
Standard Oil Co.
1801 East First St.
Dayton, Ohio

TURNLEY, M. W.
Wayne Chemical
9600 Copland
Detroit 17, Michigan

TURPIN, PAUL L.
Lincoln Engineering Co.
2415 S. Michigan Ave.
Chicago 16, Illinois

TWISS, HARRY O.
Sinclair Ref. Co.
1741 Waterman Ave.
Detroit 9, Mich.

UHL, P. W.
Detroit Diesel Engine Div. G. M.
13400 W. Outer Drive
Detroit 23, Michigan

ULBRICH, RICHARD W.
Swan-Finch Oil Corp.
RCA Bldg. West
New York 20, New York

ULMAN, DON H.
Minneapolis-Honeywell Reg. Co.
2753 4th Avenue, S.
Minneapolis, Minnesota

ULRICH, ROBERT K.
Bethlehem Steel Co.
Front Street
Steelton, Pennsylvania

UNKS, L. T.
Sun Oil Co.
3200 Independence Street
Cleveland, Ohio

URDANOFF, HOWARD D.
Bowser International, Inc.
420 Lexington Avenue
New York 17, New York

URSEM, WILLIAM A.
F & W Ursem Company
1548 West 117th Street
Cleveland 7, Ohio

VAN DER BURCH, DIRK
Shell Oil Co., Inc.
Lubricants Dept.
50 W. 50th Street
New York 20, New York

VAN EYCK, PHILIP B.
Essex Brass Corp.
2000 Franklin
Detroit 7, Michigan

VAN HEECKEREN, W. J.
Philips Labs., Inc.
145 Palisade St.
Dobbs Ferry, New York

VAN VLECK, DURBIN H.
Cuno Engineering Corp.
80 S. Vine Street
Meriden, Connecticut

VAUGHAN, C. H.
Cities Service Oil Co.
3200 S. Western Ave.
Chicago, Illinois

VICKERS, ALBERT
Dominion Fdys. & Steel, Ltd.
Depew St.
Hamilton., Ont., Canada

VOELKER, JOHN W.
DeLaval Sales & Service
447—4th Ave.
Pittsburgh 19, Pennsylvania

VOGELY, EMIL H., JR.
Cincinnati Milling Mach. Co.
3701 N. Broad St.
Philadelphia, Pennsylvania

VOGT, FRANK W.
J. T. Ryerson & Son
203 Westside Avenue
Jersey City, New Jersey

VOHS, W. A.
Sinclair Refining Co.
P. O. Box 2419
Kansas City 13, Missouri

VOLLINK, HAROLD J.
National Ref. Co.
101 Smith St.
Flint, Michigan

VON FUCHS, GEORGE H.
Shell Oil Company, Inc.
Wood River, Illinois

WACHOWICZ, JOHN S.
Sinclair Ref. Co.
2540 W. Cermak Rd.
Chicago, Illinois

WADDELL, J. N.
Henry H. Cross Co.
122 South Michigan Avenue
Chicago 3, Illinois

WAGNER, EARL E.
Hoover Ball & Bearing Co.
326 E. Hoover Avenue
Ann Arbor, Michigan

WALKER, DALLAS V.
Consumers Cooperative Assn.
1500 Iron Street
North Kansas City, Missouri

WALKER, DONALD G.
Socony-Vacuum Oil Co.
10 Light Street
Baltimore, Maryland

WALKER, GEORGE MARK
Shell Oil Company, Inc.
12 Providencia
Burbank, California

WALKER, HAROLD J.
Sinclair Refining Company
Box 186
Indianapolis, Indiana

WALKER, RICHARD B.
Sinclair Refining Co.
133 S. 36th St.
Philadelphia 4, Pennsylvania

WALLACE, JOHN S.
American Lubricants, Inc.
1575 Clinton Street
Buffalo 6, New York

WALSTRA, JESSE C.
L. R. Kerns Co.
2657 East 95th Street
Chicago 17, Illinois

WANEK, EDWARD
Gulf Refining Co.
1910 S. State Street
Indianapolis 6, Indiana

WARD, DAMIEN J.
Alemite Sales Co.
59 East 25th St.
Chicago 16, Illinois

WARDEN, MILTON A.
Warden Refining Co.
1910 S. 73rd Street
West Allis, Wisconsin

WARNECKE, CHARLES L.
Armstrong Cork Co.
Lancaster, Pa.

WARNER, JOHN T.
Carnegie—Ill. Steel Corp.
Gary Sheet and Tin Mill
Gary, Indiana

WARNER, WILLIAM P.
The Texas Co.
Lee & Aycock Sts.
Greensboro, North Carolina

WATERS, MARSHALL J.
Shell Oil Co., Inc.
100 Bush St.
San Francisco, California

WEBB, HALL O.
Alemite Co. of Okla.
1234 S. Detroit
Tulsa, Oklahoma

WEBSTER, PAUL T., JR.
Central Petroleum Co.
548 Standard Bldg.
Cleveland 13, Ohio

WEBSTER, WILLIAM W.
Harrison Radiator Corp.
West Plant
Lockport, New York

WEGMAN, THEO. H.
A. O. Smith Corp.
3533 North 27th St.
Milwaukee 1, Wisconsin

WEHKING, FRANK J.
Continental Oil Co.
1301 W. Belden Street
Chicago, Illinois

WEHLING, HERBERT C.
Alemite Sales Co.
59 E. 25th Street
Chicago, Illinois

WEIGHT, J. CLINTON
Esso Standard Oil Co.
15 W. 51st Street
New York 19, New York

WEIGHTMAN, ALBERT EDWARD
Tidewater Oil Co. of Canada, Ltd.
201 Weston Road, South
Toronto, Ontario, Canada

WEINKAUF, C. E.
The Hodson Corp.
916 Union Trust Bldg.
Pittsburgh, Pennsylvania

WEISMANN, GEORGE F.
General Petroleum Corp.
108 West 2nd St.
Los Angeles 12, California

WEISS, VICTOR A.
Allis-Chalmers Mfg. Co.
1126 South 70th St.
West Allis 14, Wisconsin

WELCH, J. FRED
Fiske Bros. Refining Co.
129 Lockwood Street
Newark 5, New Jersey

WELDON, TED H.
Alemite Co. of Nashville, Tenn.
122—15th Ave., South
Nashville, Tennessee

WENDT, PAUL W.
Grafo Colloids Corp.
431 South Dearborn St.
Chicago 5, Illinois

WENDT, PAUL W., JR.
Grafo Colloids Corp.
431 S. Dearborn St.
Chicago 5, Illinois

WENDT, W. MAYNARD
Grafo Colloids Corp.
431 S. Dearborn St.
Chicago 5, Illinois

WENTWORTH, IRA R.
Sinclair Refining
2540 W. Cermak Rd.
Chicago 8, Illinois

WERNER, JOHN L.
Monsanto Chemical Co.
1700 S. 2nd Street
St. Louis, Missouri

WERNER, ROBERT CLAUDE
Humble Oil & Refining Co.
402 Republic Bldg.
Houston 2, Texas

WESCOTT, GEORGE A., JR.
Remington Rand, Inc.
574 Main Street
Tonawanda, New York

WEST, GEORGE A.
Standard Oil Co.
221 W. Wayne Street
South Bend, Indiana

WESTBO, Warren P.
Faber Labs.
51-57 Franklin St.
New York 13, New York

WHITE, JAMES J.
Fiske Bros. Refining Co.
129 Lockwood Street
Newark 5, New Jersey

WHITE, LYSANDER THOMAS
Petroleum Advisers, Inc.
70 Pine
New York 5, New York

WHITE, ROBERT B.
Alemite Co. of So. Calif.
333 W. Washington
Los Angeles 15, California

WHITE, W. HARRY
The Atlantic Refining Co.
1100 Chamber of Commerce Bldg.
Pittsburgh 19, Pennsylvania

WHITE, ROBERT N.
Shell Oil Co., Inc.
624 S. Michigan Avenue
Chicago 5, Illinois

WHITEHEAD, DONALD E.
Carnegie Illinois Steel Corp.
Carnegie Building
Pittsburgh, Pennsylvania

WHITELEY, N. I.
American Steel & Wire Co.
Rockefeller Bldg.
Cleveland, Ohio

WHITTINGHAM, RICHARD R.
Fraser & Chalmers (S.A.), Ltd.
P. O. Box 619
Johannesburg, South Africa

WHITTLETON, THEODORE
Alox Corporation
Buffalo Avenue
Niagara Falls, New York

WIGGIN, BLANTON C.
Shell Oil Co., Inc.
313 Waverly Oaks Road
Waltham 54, Massachusetts

WIGHT, MURRAY E.
McColl-Frontenac Oil Co., Ltd.
360 St. James Street, W.
Montreal Canada

WILDER, DR. AUSTIN B.
E. I. du Pont de Nemours & Co.
1025 S. Wabash Avenue
Chicago 5, Illinois

WILEY, NORMAN DOUGLAS
Shell Oil Company, Inc.
11240 Pico Blvd., West
Los Angeles, California

WILKES, FREDERIC
National Industrial Products Corp.
Box 8611
Pittsburgh 21, Pa.

WILLEY, ARTHUR O.
The Lubri-Zol Corp.
Box 3057 Euclid Station
Cleveland 17, Ohio

WILLIAMS, DUNCAN B.
Carbide & Carbon Chem. Corp.
30 East 42nd St.
New York 17, New York

WILLIAMS, GEO. T.
Mine & Smelter Supply Co.
1422—17th
Denver 2, Colorado

WILLIAMS, ROGER G.
Cities Service Oil Co.
44th and S. Oklahoma Streets
Oklahoma City, Oklahoma

WILLIAMS, WESLEY B.
Wayne Chemical Prod.
9602 Copeland
Detroit 17, Michigan

WILLIAMSON, GEORGE
Penola, Inc.
Pt. of Deacon St.
Detroit, Mich.

WILLIS, GEORGE F.
Shell Oil Co., Inc.
12 S. 12th Street
Philadelphia, Pennsylvania

WILLIS, W.
Willis Lubricating Co.
P. O. Box No. 181
Steubenville, Ohio

WILLS, DEAN V.
Standard Oil Co. (Ind.)
Lessburg Road
Fort Wayne 8, Indiana

WILLSON, EDWARD A.
Grafo Colloids Corp.
310 Wilkes Place
Sharon, Pennsylvania

WILMOT, HENRY F. J.
Shell Oil Co., Inc.
624 S. Michigan Avenue
Chicago, Illinois

WILSON, DONALD H.
Continental Steel Corp.
South Plant
Kokomo, Indiana

WILSON, LESLIE E.
Carnegie, Ill., Steel Corp.
3426 East 89th St.
Chicago, Illinois

WING, PAUL R.
Shell Oil Co., Inc.
611 Las Juntas St.
Martinez, California

WINN, CHARLES M.
Carnegie, Ill., Steel
Salt Springs Rd.
Youngstown, Ohio

WINSLOW, CHARLES A.
Winslow Engineering Co.
4069 Hollis Street
Oakland, California

WINTER, WILLIAM R.
Standard Oil Co. (Ind.)
414 W. Michigan St.
Milwaukee 3, Wisconsin

WIRTH, CHARLES III
E. I. du Pont de Nemours & Co.
1811 S. Baltimore Ave.
Tulsa, Oklahoma

WIRTH, FLOYD J.
Cities Service Oil Co.
6611 Euclid Avenue
Cleveland, Ohio

WISE, MILTON A.
General Petr. Corp.
108 West 2nd St.
Los Angeles 12, California

WITHROW, RAYMOND C.
Freedom Valvoline Oil Co.
1008 Peoples Bank Building
Pittsburgh, Pennsylvania

WITT, C. O.
Shell Oil Co.
100 Bush St.
San Francisco 6, California

WOLMER, CHARLES E.
American Cyanamid Co.
1937 West Main St.
Stamford, Conn.

WOOD, H. STUART
American Cyanamid Co.
30 Rockefeller Plaza
New York 20, N. Y.

WOODLAND, ALVIE
Lincoln Engineering Co.
5701 Natural Bridge Ave.
St. Louis 20, Mo.

WOODS, EUGENE W.
Sinclair Refining Co.
3030 Euclid Avenue
Cleveland 15, Ohio

WOODWARD, HARRY K.
Briggs Filtration Co.
B. & O. R. R. & River Road
Bethesda 14, Maryland

WORLEY, ROBERT B.
Warren Refining & Chemical Co.
308 Euclid
Cleveland 14, Ohio

WORTHINGTON, HOWARD L.
Remington Arms Co.
939 Barnum Ave.
Bridgeport, Connecticut

WRAY, HOWARD G.
New Departure Div., G.M.C.
Sandusky, Ohio

WRIGHT, GEORGE T.
Dominion Fdys. & Steel Ltd.
Depew St.
Hamilton, Ont., Canada

WRIGHT, PAUL D.
Motor Trans. Div., City of Detroit
2650 E. Jefferson Avenue
Detroit 7, Michigan

WRIGHT, W. ANDREW
Sun Oil Company
Marcus Hook, Pa.

WRIGHT, WARREN O.
Bijur Lubricating Corp.
43-01 22nd Street
Long Island City 1, New York

WRIGHT, W. A. S.
Union Oil Co.
617 W. 7th Street
Los Angeles 14, California

WRIGHT, WILLIAM J.
Gulf Refining Co.
Maison Blanche Building
New Orleans 16, Louisiana

WUERZ, OSCAR W.
Parmelee Motor Fuel Co., Inc.
315 West 68th St.
New York 23, New York

WULFERT, OTTO
Wagner Electric Corp.
6400 Plymouth Avenue
St. Louis 14, Missouri

YARRINGTON, HORACE W.
The Texas Co.
3521 E. Michigan Street
Indianapolis 1, Indiana

YERKES, JOSEPH E.
Lincoln Engineering Co.
5701 Natural Bridge Avenue
St. Louis 20, Missouri

YERKES, JOSEPH H.
Jos. H. Yerkes & Co.
3715-17 Washington Ave.
St. Louis 8, Missouri

YOUNG, LUTHER O.
Davison Chemical Corp.
Curtis Bay 26, Maryland

YOUNG, ROY W., JR.
Union Oil Co. of Calif.
Union Oil Co. Bldg.
Los Angeles, California

YOUNG, TROY R.
7 Burke Terrace
Rochester 13, New York

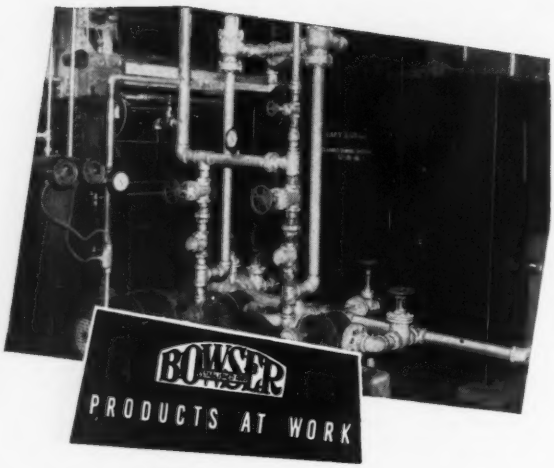
YOUNGCLAUS, WILLIAM P., JR.
Stewart-Warner Corp.
1826 W. Diversey Parkway
Chicago, Illinois

YULE, J. S.
The Pure Oil Co.
35 E. Wacker Drive
Chicago 1, Illinois

ZATWARSKY, CHESTER J.
Warner & Swasey
5701 Carnegie
Cleveland 3, Ohio

ZINO, ANTHONY JOSEPH, JR.
Swan-Finch Oil Corp.
RCA Building, West
New York 20, New York

ZURAWSKY, FRANK, JR.
Grafo Colloids Corp.
310 Wilkes Place
Sharon, Pa.



Lower-- / PRODUCTION COSTS Demand / a cushion of CLEAN OIL

The Bowser central lubricating system, partially shown above . . . and others like it in hundreds of industrial plants . . . keep cushions of oil CLEAN for many types of machinery.

Lubricant quality is maintained AUTOMATICALLY and CONTINUOUSLY by time-proved Bowser dehydrating and filtering equipment which requires little or no attention from plant personnel.

Self-contained units are available for the lubrication of individual machines.

Bowser lubrication engineers are always available for consultations and recommendations on any industrial lubricating requirement. Please write to

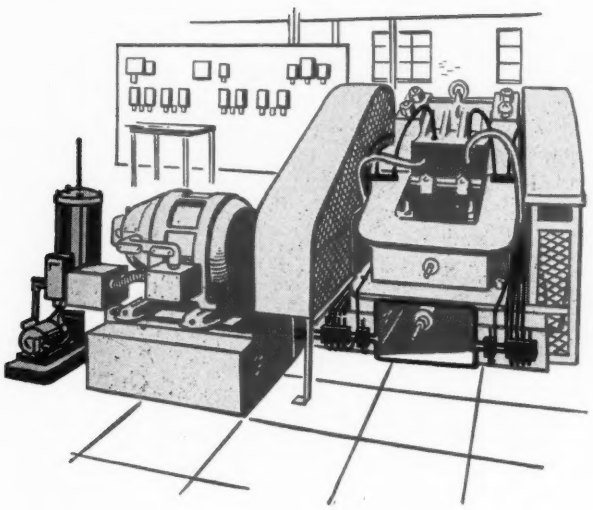
BOWSER, INC.
1358 Creighton Avenue
Fort Wayne 2, Indiana

BOWSER
ESTABLISHED 1885
LIQUID CONTROL SPECIALISTS
SINCE 1885

Advertisers IN THIS ISSUE

Acheson Colloids Corp.	243
Acro Metal Stamping Co.	278
Alemite	247
Bowser, Inc.	296
Burns Laboratories, Inc.	278
Cincinnati Milling Machine Co.	249
Cuno Engineering Corp.	246
Dow Corning Corp.	250
Farval Corporation, The	Inside Back Cover
Gits Bros. Mfg. Company	276
Grafo Colloids Corporation	275
Hodson Corporation, The	Back Cover
Houghton, E. F. & Co.	248
Lincoln Engineering Co.	244
Madison-Kipp Corporation	242
Manzel, Inc.	250
Norgren, C. A., Co.	279
Shell Oil Company, Inc.	277
Sinclair Refining Co.	279
Stuart, D. A., Oil Co., Ltd.	241
Swan-Finch Oil Corporation	281
Tide-Water Associated Oil Company	245
Trabon Engineering Corporation	Inside Front Cover
Trico Fuse Mfg. Co.	274

Stops bearing trouble on six rock crushers by installing Farval



FARVAL—*Studies in Centralized Lubrication No. 104*

FREQUENT bearing failures interfered seriously with production in an ore preparation plant. The material processed was an extremely hard flint-like rock, which not only generated tremendous bearing pressures in the crushers, but created a highly abrasive dust as well. Various methods of lubrication were tried, including drip systems, wick feeds, grease cups, and automatic oil cups. Many of these devices plugged up with dirt. Dust got into bearings and quickly ruined them, resulting in continual shutdowns for bearing replacement.

Finally, a Farval centralized lubrication system was installed on one crusher. It stopped the trouble. It was so successful that Farval systems were installed on the five other crushers. Now the swing jaw, Pitman and main eccentric shaft bearings on each crusher all receive adequate, automatic lubrication. There have been no bearing failures since Farval was installed.

Farval delivers oil or grease under pressure to a group of bearings from one central station, in exact quantities, as often as desired. It does its work while the machine is in operation. Farval —the Dualine System with the Positive Piston Displacement Valve—that has but 2 Moving Parts—is Fully Adjustable—and with a Tell-tale indicator at each bearing to show the job is done.

Write for Bulletin 25 for a full description of Farval. The Farval Corporation, 3267 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

Top Flight Lubricants

THE HODSON CORPORATION

Lubrication Engineers and Manufacturers

5301-11 West 66th Street, Chicago 38, Illinois

OFFICES IN PRINCIPAL CITIES

Delisle Auto Accessories, Ltd.
Three Rivers, Quebec (Canada)

Printed in U.S.A.